EFFECTIVENESS OF LOW OSMOLARITY ORS (WHO-ORS) WITH ZINC ON DEHYDRATION AND DIARRHOEAL STATUS AMONG THE CHILDREN AGED BETWEEN 3 MONTHS TO 5 YEARS WITH DIARRHOEA ADMITTED IN GOVERNMENT RAJAJI HOSPITAL AT MADURAI.

A DISSERTATION SUBMITTED TO THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY, CHENNAI, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN NURSING

APRIL 2014

CERTIFICATE

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ACKNOWLEDGEMENT

I praise and offer my sincere thanks to **God almighty** who gives me strength and abundant blessings throughout my successful life. I the investigator of this study, owe my sincere thanks and gratitude to all those who have contributed towards the successful completion of the endeavor.

This study can't be accomplished only through personal interest and endurance supported by many fine individuals and my love and thanks are with you.

I express sincere thanks to **Prof. K. R. Arumugam, M.Pharm.,** Correspondent, Sacred Heart Nursing College, Ultra Trust, Madurai for his support and for providing the required facilities for the successful completion of this study.

I extend my heartfelt and sincere thanks to my Research cum clinical specialty Guide **Prof. Mrs. Nalini Jeyavanth santha M.Sc., (N), Ph.D., Principal,** Sacred Heart Nursing College, Madurai for a durable work, interest, Cheerful, always with never ending willingness to provide guidance and suggestions to mould this study to the present form.

My heartfelt and faithful thanks to **Dr. Saravanan, MBBS, MD. (PEDIATRICS),** Government Rajaji Hospital, Madurai for his constant interest, special research skill and patience, guidance to make this study success.

I sincerely express my earnest thanks to **Mrs.S.Chandrakala M.Sc., (N), Ph.D. Vice Principal,** HOD of medical & Surgical Nursing Sacred Heart Nursing College, Ultra Trust, Madurai, for her expert opinion and guidance.

I owe my sincere thanks to **Dr. Juliet M.Sc. (N) Ph.D, Mrs. Devakirubai, M.Sc. (N), Ph.D.** Professors, Sacred Heart Nursing College, for their expert opinion,timely suggestions and help in this study.

I express my sincere thanks to **Mrs. Jothilakshmi, M.Sc.,(N), Ph.D** Associate professor and **Mrs.Damayanthi M.Sc.,(N),** lecture of child health Nursing Department, Sacred Heart Nursing College, for their guidance and suggestions.

I record my sincere thanks to **Mr. Jeyaram Illaiyaraja, M.Sc., M.Phil** for his excellent touch in the statistical analysis in this study.

I am thankful to **Mr. Thirunavukarasu, M.Li.Sc., Librarian,** Sacred Heart Nursing College for extending helpful support throughout the study.

I extend my sincere thanks to **Ms.A.Chris Marlyn, M.A., M.Phil,** for editing this manuscript.

My affectionate thanks to my dear lovable parents for their blessings, prayers, encouragements and support throughout the study which cannot be expressed in words.

I express my thanks to all those who have been directly or indirectly supported with study at various levels but not mentioned here.

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ABSTRACT

The study intended to evaluate the effectiveness of low osmolarity ORS (WHO-ORS) with zinc on dehydration and diarrhoeal status among the children aged between 3 months to 5years with diarrhea admitted in Government Rajaji hospital at Madurai. The conceptual framework for this study was based on J.W.Kenny's open system model. Research design for this study was Quasi-experimental-Nonequivalent control group Pretest-posttest design .The samples of the study were the children aged 3 months 5 yrs with acute diarrhoea who fulfill the inclusion and exclusion criteria and who have admitted in Government Rajaji Hospital during data collection period. The sample size for the study was 60 among 30 children were in experimental group and 30 children in control group. The consecutive sampling technique was adapted for this study. The instrument which was used for the study has three parts. It consists of demographic profile, Observational checklist on dehydration was used to assess the dehydration and Observational checklist on diarrhoeal stool has used to assess the diarrhoea. The content of the tool was validated by nine experts. Two from child health nursing ,one from community health nursing one from medical surgical nursing, four from pediatrician (child specialist doctors) and one from statistician. Reliability of the tool was established by inter -rater method. Pilot study was done to check the feasibility of conducting the study. Both descriptive and inferential statistics were used for the analysis of data. The following were the significant findings of the study the mean post tests dehydration score after administration of WHO-ORS with zinc (11)was lower than the pre-test mean (18.1).The obtained 't' value of 19.58 at df 29 was significant at 0.05 level. This indicates that the difference in mean is improvement of hydration status of the samples. The mean post tests diarrhoeal status score after administration of WHO-ORS with zinc (12.9), (9.3), (8.3) was lower than the pre test mean (16.2). The obtained't' values of 13.8, 20.9 and 26.7 at df

29 was significant at 0.05 level. The mean post tests diarrhoeal status score after administration of WHO-ORS(14.8), (12.1) and (9.5) was significantly higher than the mean post tests diarrhoeal status score after administration of WHO-ORS with zinc(12.9), (9.3) and (8.3).The obtained 't' value of 4.67, 7.43 and 4.94at df (58) was significant at 0.05 level. The mean post tests on day 2,3 and 4 the stool frequency score after administration of WHO-ORS(9.1), (6.8) and (3.7) was significantly higher than the mean post-tests stool frequency score after administration of WHO ORS with zinc(7.7), (4.3) and (2).The obtained' value of 4.87, 5.96and 5.98 at df (58) was significant at 0.05 level. The mean post tests on day 2, 3 and 4 the stool consistency score after administration of WHO-ORS (2.4), (2) and (1.5) was significantly higher than the mean post tests stool frequency score after administration of WHO-ORS with zinc (1.9), (1.3) and (1.1).The obtained't' value of 4.4, 6.76 and 3.69 at df (58) was significant at 0.05 level. The findings revealed that WHO-ORS with zinc was effectively reduce the diarrhoea among children. The result of the study implies that the administration of WHO-ORS with Zinc was effective among the children aged between 3 months to 5 years with diarrhoea.

CHAPTER - I

INTRODUCTION

BACKGROUND OF THE STUDY

"I brought children in to this dark world because it needed the light that only a child can bring"

- Liz Armbruster

"Children are the world's most valuable resource and its best hope for the future"

- John Fitzgerald Kennedy

The child is the most precious possession of mankind, most loved and perfect in its innocence. The child represents that face of man which is always new. With every child we are born again and we play in the courtyard of the world in the bright sunshine of love and laughter.

According to World health organization (2013) Diarrhoeal disease is the second leading cause of death in children under five years old, and is responsible for killing around 760, 000 children every year. Diarrhoea can last several days, and can leave the body without the water and salts that are necessary for survival. Most children who die from diarrhoea actually die from severe dehydration and fluid loss. Children who are malnourished or have impaired immunity as well as people living with HIV are most at risk of life-threatening diarrhoea.

According to rehydration project (2011) children are more likely than adults to die from diarrhoea because they become dehydrated more quickly. Diarrhoea is also a major cause of child malnutrition.1.35 million people in developing countries, most of them children, die every year from diarrhoeal diseases associated with lack of access to safe drinking water, inadequate sanitation, poor hygiene and overcrowding. 90% are children

under 5, mostly in developing countries. Under nutrition is the underlying cause of a substantial proportion of all child deaths.

As reported by World health organization (2011) the annual incidence of diarrhoeal illness is 2.8 billion and 4.3 million associated deaths are occurring due to diarrhoea among children in each year, with an average of 3.3 episodes of diarrhea per year in a child less than 5 years of age. Greater than 6 lakhs of children die every month and 10,000 childhood deaths occur every day due to diarrhoea. The greater tragedy is that, most of these children died because they were not given ORS. The total diarrhoeal morbidity for children was one – third during their first 2 year of life. Overall, children were ill for 15 percent to 20 percent of their first 3 years of life due to diarrhoea.

According to Shamima and Charles (Sep 2009) Worldwide, diarrhoeal diseases are responsible for 59 million disability-adjusted life years (DALYs) lost annually and 1.6 million under-5 deaths. Although deaths due to diarrhoea have fallen substantially over the past four decades, there has not been a concurrent decrease in morbidity rates attributable to diarrhoea. Young children in the developing world continue to experience a median of between two and four episodes of diarrhoea every year.

World Bank officials (2010) estimate that there are 4.5 lakh deaths out of 57.5 crore cases of diarrhoea every year in India and a large segment of the country's 1.20 crore population defecates in the open. Each child had 5 to 7 episodes of diarrhoea by the age of 5 years. Nearly 10 percent of all hospitalized under five children are associated with diarrhea.

Kamalakannan anbarasu (2011) reported that in developing countries, a majority of people living in rural areas almost exclusively use traditional medicines in treating all

sorts of diseases including diarrhoea. Diarrhoea is a major health problem, especially for children under the age of 5 and up to 17% of children admitted in the pediatric ward die of diarrhoea. Worldwide distribution of diarrhoea accounts for more than 5-8million deaths each year in infants and children below 5 years old especially in developing countries.

According to the WHO's Department of Food Safety, (2001) "Secretary diarrhoea is the most dangerous symptoms of gastrointestinal problems and diarrhoea kills around 2.2 million people each year and infects around 4 billion people in a year". Most deaths occur in children particularly due to dehydration. The incidence of diarrhoeal disease still remains high despite the efforts of many governments and international organizations to curb it. It is therefore important to identify and evaluate available resources as alternatives to currently used anti-diarrhoeal drugs which are not always free from adverse effects.

Stephanie Barber et al (2011) reported that in southern Indian state of Tamil Nadu, the diarrhoeal disease is significant for children under the age of five, especially children living in rural areas. It is reported that 70% of rural children who visited health care provider did not receive proper treatment with oral rehydration solution (ORS). This increases the child's risk of morbidity as a result of complications from diarrohea. In Tamilnadu, dehydration due to diarrhoea is a major health problem among children. Approximately 5 percent children die each year from this potentially preventable condition. It was estimated that 4,800 children die annually due to acute diarrhoeal diseases.

According to world health report (2003) oral rehydration salts and oral rehydration therapy (ORT), adopted by UNICEF and WHO in the late 1970, have been successful in helping manage diarrhoea among children. It is estimated that in the 1990s, more than 1 million deaths related to diarrhoea may have been prevented each year, largely attributable to the promotion and use of these therapies.

SIGNIFICANCY AND NEED FOR STUDY

Diarrhoea is defined as the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual). Frequent passing of formed stools is not diarrhoea, nor is the passing of loose, "pasty" stools by breastfed babies. Diarrhoea is usually a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person-to-person as a result of poor hygiene.

According to Stephanie Barber, Erin Leege and Erin Richardson (2011) Diarrhoeal disease represents a serious global health concern, particularly in low-resource settings throughout the developing world. Morbidity and mortality rates are highest globally among children under the age of 5, with millions of preventable deaths occurring each year as a result. As nearly one-quarter of all childhood diarrheal deaths occur in India, there exists great demand for programs and interventions to combat this pressing public health challenge.

According to world health media centre (April 2013) Diarrhoeal disease is the second leading cause of death in children under five years old. It is both preventable and treatable. Each year diarrhoea kills around 760,000 children under five. Globally, there

are nearly 1.7 billion cases of diarrhoeal disease every year. Diarrhoea is a leading cause of malnutrition in children under five years old.

Alix Peterson Zwane and Michael Kremer (2006) reported that diarrhoeal disease is estimated to cause 2 million deaths in the developing world each year; the vast majority of these are among children younger than 2 years. Currently, 1 out of every 200 children who contract diarrhoea will die of its consequences, including particularly dehydration. Almost all of these deaths could be prevented with the timely use of a simple and low-cost treatment for dehydration. This happens most often where there is unsafe disposal of faeces, poor hygiene practices or a lack of clean drinking water. Or when infants are not breast fed. Infant who are feed only breast milk seldom get diarrhoea.

Causes of Child Deaths in Low-Income Countries: Diarrhoea 18%

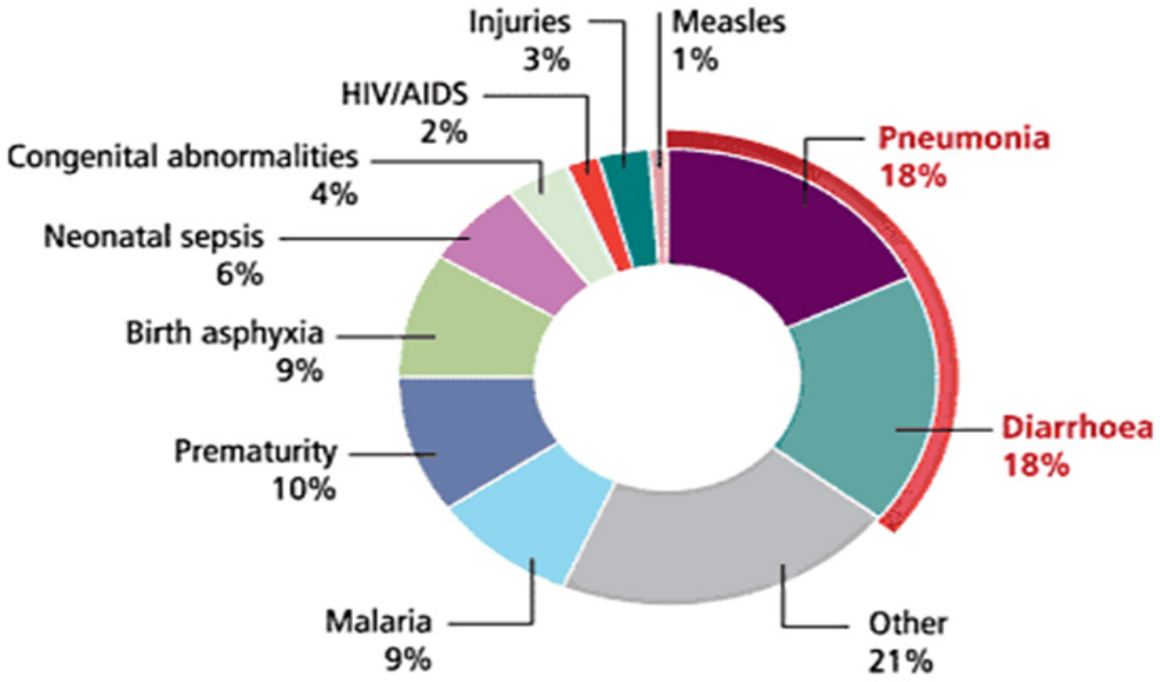

Fig.1 Source: WHO, World Health Statistics 2011

As per IKP Centre for Technologies in Public Health (ICTPH), (2011) India leads the world in child mortality due to diarrhoeal disease, with approximately 386,600 deaths. This disease accounts for approximately 13% of under-5 deaths in the country, and is the second leading cause of death for children between 5-14 years of age (14.5%). In addition, diarrhoeal disease is the number 1 reason for hospitalization among children under the age of 14 years and accounts for 16.8% of hospitalizations for children in rural settings. Such mortality and morbidity has significant consequences for India. According to the National Institute of Cholera and Enteric Disease (NICED), the lost disability adjusted life years (DALY) for Indian children between the ages of zero and six because of diarrhoea is 10,087,186.The NICED estimates that these numbers will continue to increase over time.

According to UNICEF (2013) diarrhoea kills some 800,000 children under 5 each year. Deaths can be prevented by a simple and inexpensive public health solution - oral rehydration salts therapy (ORS) in combination with zinc formulated as dispersible tablets. Studies show that zinc supplementation results in a 25% reduction in duration of acute diarrhoea and a 40% reduction in treatment failure or death in persistent diarrhoea. These studies also revealed that children receiving zinc simultaneously experience a decrease in the severity of their diarrhoea episodes. A 10-14 days course has proven to provide protection against future bouts of diarrhoea for up to 2-3 months.

Rehydration project (2011) reported that Diarrhoea is associated with 18% mortality among children aged <5 years, accounting for 1.9 million deaths, primarily in developing countries. Despite advances in the use of oral rehydration therapy (ORT), diarrhoea-associated mortality has not declined significantly in the past few years. The

continued high mortality underscores a need for further improvements in case management and primary prevention. Dietary deficiency of some micronutrients has been shown to increase the susceptibility of infants and children to gastrointestinal infections and to have direct adverse effects on gastrointestinal tract structure and function.

As stated by Meenakshi Mehta, (2004) a quarter century after ORT was introduced to the world, it has indeed came a long way in a short time and is now at a turning point. Annually ORT saves over one million young lives a year. Thus, ORT is rightly considered the most important medical advance of this century as it has revolutionized the treatment of diarrhoeal disease. Today, one in 3 children stricken with diarrhoea and receive ORT at home resulting in the prevention of about 3000 child deaths each day. Ironically even today more than 2 million under fives in the world's poorest neighborhoods still die every year of diarrhoeal dehydration or malnutrition if the episodes of diarrhoea are recurrent or prolonged. In 90% children with dehydration, ORT can reduce the hospital admission rate and diarrheal mortality by 50 % and limit weight loss. In addition, ORT using the present ORS formulation is one of the least expensive health interventions. Only one of ten diarrhea cases requires antibiotics as well as oral rehydration therapy. ORS sachets are widely available in India for approximately Rs. 5/-

LOW OSMOLARITY ORS

Rehydration project (2013) reported that new and improved ORS will save more lives-For more than 25 years, WHO and UNICEF have recommended a single formulation of glucose based ORS to prevent or treat diarrhoeal dehydration, no matter the cause or affected age group. This solution has played a major role in dramatically reducing global mortality due to diarrhoea. During this time, researchers sought to

develop an 'improved' ORS formulation that was as safe and effective as the original in preventing and treating diarrhoeal dehydration but also reduced stool output or offered additional clinical benefits, or both. One research effort focused on reducing the osmolarity of ORS solution to avoid possible adverse effects of hypertonicity on net fluid absorption. Reducing the concentrations of glucose and salt (NaCl) in the solution accomplished this goal. Studies of this approach show that decreasing the sodium concentration of the ORS solution to 75 mEq/l, the glucose concentration to 75 mmol/l, and the total osmolarity to 245 mOsm/l improved the efficacy of the ORS regimen for children with acute non-cholera diarrhoea.

Recent studies of reduced osmolarity ORS solutions (osmolarity 210-268 mOsm/l, sodium 50–75 mEq/l) found that stool output decreased by about 20 per cent and vomiting by about 30 per cent. The reduced osmolarity(245 mOsm/l) solution also appeared to be as safe and effective as standard ORS for use in children with cholera.

Zinc supplementation

Jones (2003) Rationale for zinc supplementation in Treatment of diarrhoea with oral rehydration solution (ORS) reduces mortality due to dehydration. Zinc supplementation could help reduce the duration and the severity of diarrhoea, and therefore have an additional benefit over ORS in reducing children mortality.

ADVANTAGES

Izincg and Wagstaff (2004) stated that Zinc deficiency is mainly due to inadequate dietary intake and is estimated to be common in many countries. High levels of zinc are found in 'expensive foods' (eg .meat and fish). Zinc is also present in nuts, seeds, legumes, and whole grain cereal, but the high phytate content of these foods

interferes with its absorption. Zinc cannot be stored in the body, and nearly 50% of zinc excretion takes place through the gastro-intestinal tract and is increased during episodes of diarrhoea. Young children who are regularly exposed to gastrointestinal pathogens and have diets low in animal products and high in phytate-rich foods are most at risk.

According to World Health Organization (2004) zinc treatment is a simple, inexpensive, and critical new tool for treating diarrhoeal episodes among children in the developing world. This important micronutrient becomes depleted during diarrhea, but recent studies suggest that replenishing zinc with 10- to 14-day course of treatment can reduce the duration and severity of diarrhoeal episodes and may also prevent future episodes for up to three months. The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) issued a joint statement regarding the clinical management of acute diarrhoea. This statement recommended the use of zinc treatment, as well as a new formulation of oral rehydration solution (ORS), as a two-pronged approach to treatment.

With this background the researcher intended to study the effectiveness of zinc with low osmolarity WHO-ORS in south India among children with diarrhea. In Tamilnadu the zinc supplementation is not routinely prescribed with diarrhoea in children so,the researcher is interested to carry out the study .This finding may help the nurses to make appropriate nursing measures which are directed towards minimizing the complications related to diarrhoea.

STATEMENT OF THE PROBLEM:

A study to evaluate the effectiveness of WHO ORS with zinc on dehydration and diarrhoeal status among the children aged between 3 months to 5 years with diarrhoea admitted in Government Rajaji Hospital at Madurai.

OBJECTIVES OF THE STUDY:

1. To assess the pre-test and post-test dehydration and diarrhoeal status among the children in experimental group who had WHO ORS with zinc.
2. To assess the pre test and post test dehydration and diarrhoeal status among the children with diarrhea in control group.
3. To evaluate the effectiveness of WHO ORS with zinc on dehydration status among children with diarrhea in experimental group.
4. To evaluate the effectiveness of WHO ORS with zinc on diarrhoeal status among children with diarrhea in experimental group.
5. To find out the association between the pre-test dehydration status and selected demographic variables (age, sex, literacy level of the parents, drinking water-source, sanitation, toilet facility and hand washing habit) in experimental group and control group.

HYPOTHESIS

The following hypotheses were tested at 0.05 level of significance,

H_1: The mean post-test dehydration status in the experimental group of children who had WHO ORS with zinc will be significantly lesser than the mean pre-test level of dehydration status.

H_2: The mean post-test diarrhoeal status in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean pre-test level of diarrhoeal status.

H_3: The mean post-test dehydration status in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean post-test dehydration status in the control group.

H_4: The mean post-test diarrhoeal status in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean posttest diarrhoeal status in the control group.

H_5: The mean post-test stool frequency score in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean posttest stool frequency score in the control group.

H_6: The mean post-test stool consistency score in the experimental group of children who had WHO ORS with zinc will be significantly lesser than the mean post test stool consistency score in the control group.

H_7: There will be a significant association between pre-test diarrhoeal status of the children and selected demographic variables (age, sex, literacy level of the parents, drinking water-source, sanitation, toilet facility and hand washing habit).

OPERATIONAL DEFINITIONS

EFFECTIVENESS:

Effectiveness is the capability of producing a desired result. When something is deemed effective, it means it has an intended or expected outcome.

It refers to the outcome of administering WHO ORS with zinc in improving the dehydration and control the diarrhoea frequency among children with diarrhoea and it is the difference in the mean post-test dehydration status and diarrhoeal status between the experimental and control group, And also it is measured by observational check list on dehydration and observational checklist on diarrhoeal status.

ORAL REHYDRATION SALTS:

Oral rehydration salts (ORS) is a special drink that consists of a combination of Sodium, Chloride, Glucose, Anhydrous, Potassium and Citrate salts. When properly mixed with safe water, the ORS drink can help to rehydrate the body when a lot of fluid and electrolyte has been lost due to diarrhea.

WHO ORS

The following quantities of reconstituted oral rehydration salts have given by world health organization (WHO).

COMPOSITION OF REDUCED OSMOLARITY ORS

Reduced osmolarity ORS	grams/litre
Sodium chloride	2.6
Glucose, anhydrous	13.5
Potassium chloride	1.5
Trisodium citrate, dihydrate	2.9
Total weight	20.5

Reduced osmolarity ORS	Mmol /litre
Sodium	75
Chloride	65
Glucose, anhydrous	75
Potassium	20
Citrate	10
Total osmolarity	245

ZINC

In this study zinc refers to a mineral that is essential to the body and is a constituent of many enzymes that permits chemical reactions to proceed at normal rates. Zinc is involved in the manufacture of protein (protein synthesis) and in cell division.

Zinc supplementation, at a dosage of 20 milligrams per day for children older than six months and 10 mg per day for children younger than six months has used as per WHO. In this study "ZIORAL" a commercially available zinc gluconate has given as per the WHO dosage regimen.

DEHYDRATION

In this study it refers to a condition caused by the excessive loss of water from the body, which causes a rise in blood sodium levels. Water loss is usually accompanied by a deficiency of electrolytes.

According to WHO guideline the features of dehydration like the condition of the child, anterior fontanels, eyes, tears, mouth and tongue, thirst, heart rate, respiratory rate, skin turgor and urine output should be observed. If untreated, severe dehydration can lead to shock.

DIARRHOEA

In this study diarrhoea refers to the passage of unusually loose or watery stools, usually at least three times in a 24 hour period. However, it is the consistency of the stools rather than the number that is most important.

ASSUMPTIONS

1. The major cause of death in children with diarrhoea is due to acute dehydration.
2. Low osmolority ORS reduces the hyponatraemic dehydration and the stool out.

3. Zinc supplementation improves the absorption of water and electrolytes and improves re-generation of the intestinal epithelium.

DELIMITATION

1. The study was limited to children aged 3 months to 5 years with a history of acute diarrhoea with <10 percentage of dehydration.
2. The study was conducted only in Government Rajaji Hospital in Madurai.
3. The data collection period was delimited to a period of 6 weeks.

PROJECTED OUTCOME

The study findings will help the nurses and other health care workers to determine the need for the ORS and zinc to save the life of the children with diarrhea.

CONCEPTUAL FRAMEWORK

Based on J.W. Kenny's open system model

All living systems are open, in that there is a continual exchange of matter energy and information. open systems have varying degrees of interaction with the environment from which the system receives input and gives back output in the form of matter, energy and information. For survival, all systems must receive varying types and amount of matter, energy and information.

The main concepts of the open system model are INPUT, THROUGHPUT, OUTPUT and FEEDBACK.

Input:

Input refers to matter, energy and information that enter into the system through its boundary. In this study the input will be administering the WHO ORS with zinc to experimental group.

Throughput:

Throughput refers to processing where the system transforms the energy, matter and information. The throughput will be the mechanism by WHO ORS with zinc acts on intestinal mucosa to aid in re-absorption of water and electrolytes that will control the diarrhoea.

Output:

Output refers to matter, energy and information that are processed. The output will be the control of stool frequency and correction of dehydration.

Feedback:

After processing input, the system sends output to environment in an altered state.

Feedback refers to environment responses to the system's output used by the system adjustment, correction and accommodation to the interaction with the environment. In this study it is used, if there is inadequate correction of dehydration and diarrhoeal status.

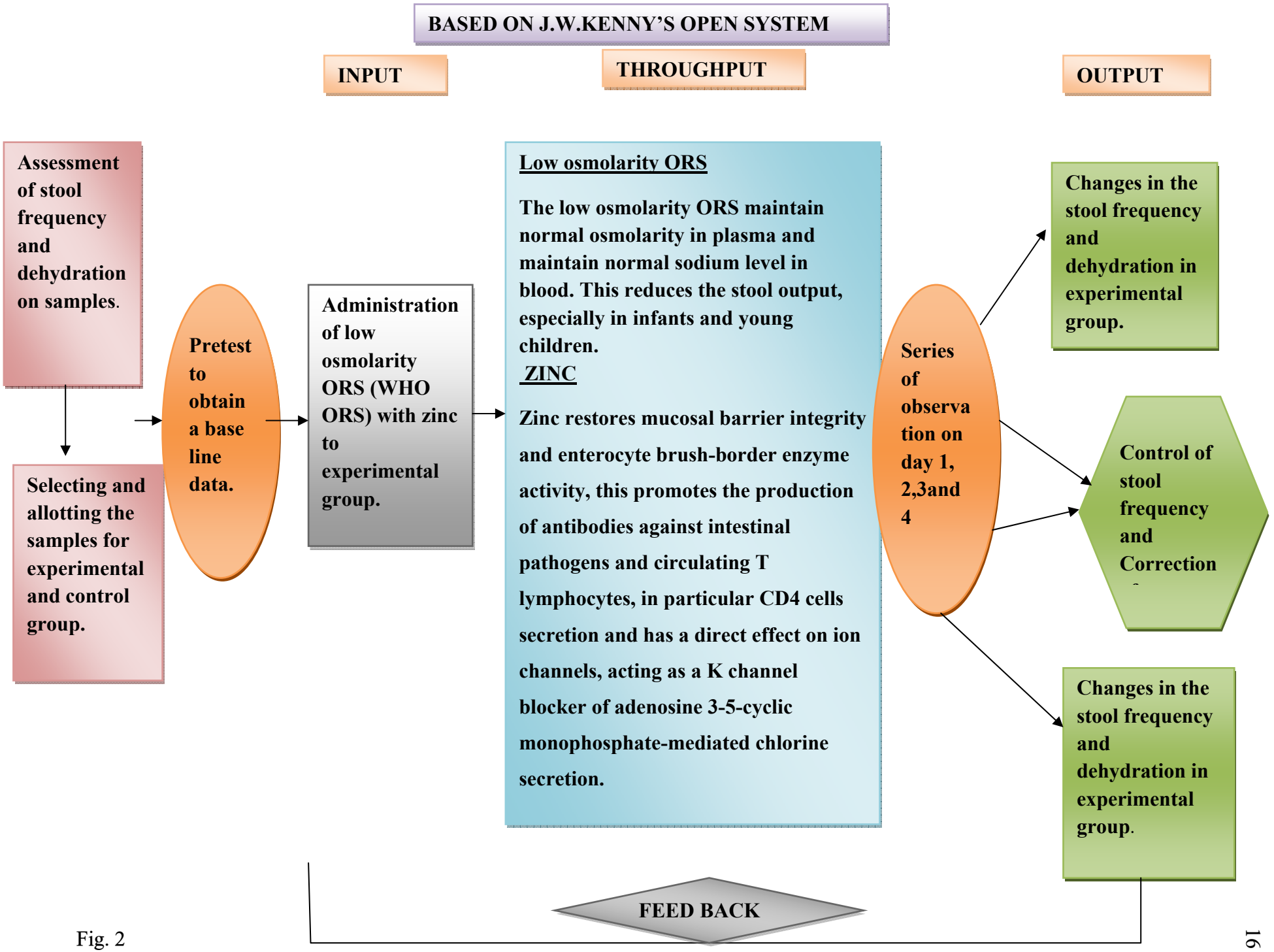
BASED ON J.W.KENNY'S OPEN SYSTEM
INPUT
THROUGHPUT
OUTPUT
Assessment of stool frequency and dehydration on samples.
Selecting and allotting the samples for experimental and control group.
Pretest to obtain a base line data.
Administration of low osmolarity ORS (WHO ORS) with zinc to experimental group.
Low osmolarity ORS
The low osmolarity ORS maintain normal osmolarity in plasma and maintain normal sodium level in blood. This reduces the stool output, especially in infants and young children.
ZINC
Zinc restores mucosal barrier integrity and enterocyte brush-border enzyme activity, this promotes the production of antibodies against intestinal pathogens and circulating T lymphocytes, in particular CD4 cells secretion and has a direct effect on ion channels, acting as a K channel blocker of adenosine 3-5-cyclic monophosphate-mediated chlorine secretion.
Series of observation on day 1, 2,3and 4
Changes in the stool frequency and dehydration in experimental group.
Control of stool frequency and Correction
Changes in the stool frequency and dehydration in experimental group.
FEED BACK

Fig. 2

CHAPTER - II

REVIEW OF LITERATURE

According to Polit and Hungler (2003), researchers often undertake a literature review to familiarize themselves with that knowledge base. The studies are usually undertaken within the content of an existing knowledge base. The term literate refers to the activities involved in identifying and searching for information on a topic and developing of the state of knowledge on the topic.

The literature is classified under the following headings:

I.LITERATURE RELATED TO DIARRHOEA IN CHILDREN.

a) Literature related to incidence of diarrhoea
b) Literature related to causes of diarrhoea
c) Literature related to pathophysiology of diarrhoea
d) Literature related to signs and symptoms of diarrhoea
e) Literature related to diagnostic evaluation in children with diarrhoea
f) Literature related to management of diarrhoea

II. LITERATURE RELATED TO ORAL REHYDRATION SOLUTION IN DIARRHOEAL MANAGEMENT

III. LITERATURE RELATED TO LOW OSMOLARITY-ORS IN DIARRHOEAL MANAGEMENT

IV. LITERATURE RELATED TO LOW OSMOLARITY ORS (WHO-ORS) WITH ZINC IN MANAGEMENT OF DIARRHOEA.

I.LITERATURE RELATED TO DIARRHOEA IN CHILDREN.

The word diarrhoea is a Greek word. The meaning is to “flow through”.

According to Whyte and Jenkins (October 2012) Diarrhoea is defined as the rapid transit of gastric contents through the bowel. The frequency of defecation is variable in childhood, but the median is one bowel movement per day.

The World Health Organization describes diarrhoea as three or more loose or watery stools per day. (Or more frequent passage than is normal for the individual). Frequent passing of formed stools is not diarrhoea, nor is the passing of loose, "pasty" stools by breastfed babies. The absorption and secretion of water and electrolytes in to the gut is a finely balanced, dynamic process and, when there is loss of this balance, diarrhoea results There are four clinical types of diarrhoea:

- Acute watery diarrhoea – lasts several hours or days, and includes cholera;
- Acute bloody diarrhoea – also called dysentery; and
- Persistent diarrhoea – lasts 14 days or longer.
- Chronic diarrhea – If the duration of symptoms is longer than 1 month, it is considered chronic diarrhea.

a. Literature related to incidence of diarrhoea

- United Nations and World Health Organization (2004) stated that about 1.5 million children under five die of diarrhoea every year. While the highest number of deaths occurs in Africa and 38 per cent deaths took place in South Asia, in 2004, India accounted for the highest number of deaths. WHO revealed that diarrhoeal mortality rate over the past two decades declined from an estimated 5 million deaths among children under five to 1.5 million deaths in 2004.Despite

this drop, diarrhoea remains the second most common cause of death among children under five globally, following pneumonia, the leading killer of children. Among the 15 countries of South Asia, India accounts for the highest number of deaths, much above China, Pakistan and Bangladesh. As per the report, India witnessed 3,86,600 deaths due to diarrhoea in 2004, followed by Nigeria (1,51,700 deaths) in the same period. The Democratic Republic of the Congo has reported 89,900 deaths, followed by Afghanistan (82,100), Ethiopia (73,700), Pakistan (53,300), Bangladesh (50,800) and China (40,000) in 2004.

According to UNICEF (2009), globally, 5 million cases of diarrhoea occur annually in children under five year old. One fourth to one third of all deaths in children are due to diarrhoea. In developing countries every third of the pediatric beds are occupied by diarrhoea cases. In developing countries, an estimated 1.3 thousand million episodes of diarrhoea and 3.2 million deaths occur each year in those under five years of age. Overall these children experience an average of 3.3 episodes of diarrhoea per year, but in some areas the average exceeds nine episodes per year. The median incidence of diarrhoea is greatest for infants aged 6 – 11 months (5 episodes /child /year). Nearly one in five child deaths – about 1.5 million each year – is due to diarrhoea. Diarrhoea is more prevalent in the developing world due to the lack of safe drinking water, sanitation and hygiene, as well as poorer overall health and nutritional status.

Cynthia and Lana (2008) conducted a study to "estimate child mortality due to diarrhoea in developing countries". The major objective of the study is to provide estimation of diarrhoea mortality at country, regional and global level by employing the child health epidemiology reference group (CHERG) standard. Information was collected

on characteristics of each study and its population. A regression model was used to relate thus characteristics to proportional mortality from diarrhoea and its distribution in national populations. The result shows that, global deaths from diarrhoea of children aged less than five years were estimated at 1.87 million(95% confidence interval, cl: 1.56 – 2.19), approximately 19% of total child deaths. Planning and evaluation of interventions to control diarrhoeal death and to reduce under five mortality is obstructed by the lack of a system that regularly generates cause of – death information.

Emily White Johansson and Tessa Wardlaw (2009) reported that together, pneumonia and diarrhoea account for an estimated 40 per cent of all child deaths around the world each year. Nearly one in five child deaths is due to diarrhoea, a loss of about 1.5 million lives each year. The toll is greater than that caused by AIDS, malaria and measles combined. Africa and South Asia are home to more than 80 per cent of child deaths due to diarrhoea . Just 15 countries account for almost three quarters of all deaths from diarrhoea among children in under five years of age annually.

As stated in World Gastroenterology Organization Global Guidelines (2012) there are about two billion cases of diarrheal disease worldwide every year, and 1.9 million children younger than 5 years of age perish from diarrhea each year, mostly in developing countries. This amounts to 18% of all the deaths of children under the age of five and means that more than 5000 children are dying every day as a result of diarrheal diseases. Mortality from diarrhea, 78% occur in the African and South-East Asian regions.

As reported by Media centre WHO (2012) Diarrhoeal disease is a leading cause of child mortality and morbidity in the world, and mostly results from contaminated food

and water sources. Worldwide, 780 million individuals lack access to improved drinking-water and 2.5 billion lack improved sanitation. Diarrhoea due to infection is widespread throughout developing countries. In developing countries, children under three years old experience on average three episodes of diarrhoea every year. Each episode deprives the child of the nutrition necessary for growth. As a result, diarrhoea is a major cause of malnutrition, and malnourished children are more likely to fall ill from diarrhoea.

According to a UN Report (2012) almost 5,000 under five children die daily in India. More children under the age of five died in India than anywhere else in the world. The study estimates that for every 1,000 children born in India, 61 are unlikely to make their fifth birthday. That rate is higher than in Rwanda (54 child deaths), Nepal (48 child deaths) or Cambodia (43 child deaths).The report showed the main causes of child deaths worldwide are pneumonia, responsible for 18% of deaths, followed by diarrhea (11% of deaths). India stands out for the prevalence of diarrhea among infants. Diarrhea was responsible for 13% of child deaths in India in 2010 – the second-highest rate after Afghanistan.

Shinjini Bhatnagar et al (2013) conducted the study called (Global Enteric Multicenter Study -GEMS). In this study they had enrolled more than 20,000 children from seven sites across Asia (including India) and Africa. With approximately 4,57,000 to 8,84,000 hospitalizations and two million outpatient clinic visits each year in Indian children. This study pinpoints the key causes of childhood diarrhoea and suggests a roadmap to save hundreds of thousands of lives. In India, the study was conducted in Kolkata at the National Institute of Cholera and Enteric Diseases. Infants under 11

months at Kolkata showed the highest burden, with roughly 90 episodes of Moderate to Severe diarrhoea per 100 children each year.

According to WHO (Sep 2013) 6.6 million children under the age of five died in 2012. More than half of these early child deaths are due to conditions that could be prevented or treated with access to simple, affordable interventions. Leading causes of death in under-five children are pneumonia, preterm birth complications, birth asphyxia, diarrhoea and malaria. About 45% of all child deaths are linked to malnutrition. Children in sub-Saharan Africa are about over 16 times more likely to die before the age of five than children in developed regions.

A study conducted by Fayaz, Muzaffar, and Mattoo (July 2008)in Kashmir, to find the burden of diarrhoeal disease and the effect of a temperate climate (as compared to a tropical one in rest of India)on the pattern of diarrhoeal disease in Kashmir valley. Cross sectional study was carried out using pretested interview schedule. Overall period (last 15 days) and point (24 hrs) prevalence rates of diarrhoeal diseases among children under age of 5 years were calculated which came to the order of (25.2%) and (9.3%) respectively. Prevalence of diarrhoea decreased significantly with increased age and in summer months. The burden of diarrhoeal disease in Kashmir is quite high, like most places in the developing world. The age pattern and seasonal pattern of diarrhoeal disease also resembles that found in studies across India and the developing world.

Fischer Walker et al, (2010) conducted a systematic review funded by Johns Hopkins Bloomberg School of Public Health on incidence of diarrhoea in low- and middle-income countries in 1990 and 2010. They conducted a systematic literature review to quantify diarrhea incidence among any age group of children 0-59 months of

age. They estimated that incidence has declined from 3.4 episodes/ child in 1990 to 2.9 episodes/ child in 2010. In 139 countries there were nearly 1.9 billion episodes of childhood diarrhea in 1990 and nearly 1.7 billion episodes in 2010.They concluded that Although their results indicate that diarrhea incidence rates may be declining slightly, the total burden on the health of each child due to multiple episodes per year is tremendous and additional funds are needed to improve both prevention and treatment practices in low- and middle-income countries.

Nirmalya Dutta (2013) stated in health India that, over 3 lakh children in India die from diarrhoea-related diseases every year. With our country's maternal and infant mortality rate being the worst in the world, it seems the government is unable to find an appropriate solution to the problem.

b) Literature related to causes of diarrhoea

Diarrhoea may have many different causes including:

- A viral infection.
- A bacterial infection (food poisoning)
- A change in diet
- Food intolerance (e.g. Lactose);
- Inflammatory bowel disorder;
- Medicines (e.g. Antibiotics, magnesium-containing antacids);

Causes of acute, and chronic or persistent diarrhoeal disorders

ACUTE DIARRHOEA

- ❖ Infections
- ❖ Drugs or poisons

- ❖ Immediate onset hypersensitivity reactions

CHRONIC OR PERSISTENT DIARRHOEA

- ➢ Infections with parasites such as cryptosporidium and giardia
- ➢ Other infections, usually in the presence of specific risk factors such as malnutrition, immune deficiency (including HIV, post measles), associated illnesses (pneumonia, urinary tract infections), or mucosal injury
- ➢ Congenital disorders of digestion and absorption including:
- ➢ Exocrine pancreatic insufficiency (eg, cystic fibrosis)
- ➢ Enteropathies (coeliac disease, food allergies, autoimmune disorders)
- ➢ Specific enzyme defects (sucrase-isomaltase deficiency)
- ➢ Transport defects (glucose-galactose transporter)
- ➢ Congenital intractable diarrhoea (microvillus inclusion disease, tufting enteropathy)
- ➢ Short gut syndrome (bowel resection after necrotizing entericolitis)

As stated by Washington Bangla Radio (Dec 2010) in New Delhi, diseases are rising at an alarming rate among the human population especially in a country like India. The World Bank estimates that out of the growing spate of diseases, 21% of communicable diseases are water related. It comes as no surprise that the 4 billion annual cases of diarrheal disease are attributed to unsafe water and inadequate sanitation and hygiene in India.

Jacqueline et al,(2009) conducted a study to find out the Disease and economic burden of rotavirus diarrhoea in India, Rotavirus infections are the most common cause of severe gastroenteritis in children <5 years of age worldwide and account for 5% of all

deaths among children in this age group. An estimated 527,000 deaths are attributable to rotavirus each year with most rotavirus-associated deaths occurring in sub-Saharan Africa and South Asia. Over 20% of these deaths are estimated to occur in India alone. Moreover, rotavirus is responsible for 25–50%of all diarrheal hospitalizations in both developing and developed countries and 23 million outpatient visits annually. By age 5years, almost every child will have been infected by rotavirus.

According to UNICEF-WHO Joint Monitoring Programme Report (2010), nearly 60 percent of India's 1.1 billion people still practice open defecation and close to 58 percent of all open defecation in the world is in India and the government is likely to spend Rs 150 milion to fight the problem. While, this particular problem might not be the reason for urban kids suffering from diarrhoea, there are few other things with children suffer from the disease. Apart from the rotavirus, there are a number of other organisms that can cause diarrhoea. Bacteria like Salmonella, Shigella, Campylobacter, and various forms of *Escherichia coli,* parasites like jade, Cryptosporidium and Entamoeba can be the causative agents in a number of cases. There are other things that could lead to diarrhoea in an infant, for example an allergy to certain foods like milk and soya. A fairly common condition seen is something called 'toddlers' diarrhoea'. This is where the child suffers from loose motions because the child has too much fluid. It leads to the digestive system getting overwhelmed by the amount of fluids and sugar leading to diarrhoea. When a child has an infection that leads to diarrhoea, it is called gastroenteritis.

According to united nations children's fund (June 2012) Infants who are exclusively breastfed for the first six months of life and who receive continued

breastfeeding through age two and older develop fewer infections and suffer less severe illness than those not breastfed. This is particularly true for pneumonia and diarrhoea. The risk of increased morbidity and mortality due to pneumonia and diarrhoea is higher for infants who are not exclusively breastfed. This effect may be larger among children in poor settings, for example, where maternal literacy or access to improved sanitation is low. However non-breastfed infants in industrialized countries also suffer more infectious illnesses than do breastfed infants. In low-income countries low birth weight due to preterm delivery or restricted foetal growth results largely from poor maternal health and nutrition. Low birth weight places newborns at higher risk of dying during the early months and years of life, particularly due to infections such as diarrhoea and pneumonia. India alone is home to 40 per cent of low-birth weight newborns.

As stated by UNICEF millennium goals (2012) diarrhoeal disease is a leading cause of child mortality and morbidity in the world, and mostly results from contaminated food and water sources. Worldwide, 780 million individuals lack access to improved drinking-water and 2.5 billion lack improved sanitation. In developing countries, children under three years old experience on average three episodes of diarrhoea every year. Each episode deprives the child of the nutrition necessary for growth. As a result, diarrhoea is a major cause of malnutrition, and malnourished children are more likely to fall ill from diarrhoea.

According to Global Enteric Multicenter Study (May 2013) diarrhoea is a disease that is spread from one person to another due to infection from an organism. According to this study statistics, India falls behind the rest of the world because of the large number of people who do not have access to proper bathrooms which leads to open defecation, a

practice common in rural parts of the country. Also the report was found that the most common diarrhoea causing virus is the rotavirus. This virus is mainly spread by the fecal-oral route**.** This means that the virus spreads from one person to another when the food or water they consume is contaminated.

c) Literature related to pathophysiology of diarrhoea

Diarrhea is an increase in the volume of stool or frequency of defecation. It is one of the most common clinical signs of gastrointestinal disease, but also can reflect primary disorders outside of the digestive system. Certainly, disorders affecting either the small or large bowel can lead to diarrhea.

PATHOPHYSIOLOGY

As stated by Bowen (2006) there are numerous causes of diarrhoea, but in almost all cases, this disorder is a manifestation of one of the four basic mechanisms described below. It is also common for more than one of the four mechanisms to be involved in the pathogenesis of a given case.

- ❖ Osmotic Diarrhoea
- ❖ Secretory Diarrhoea
- ❖ Inflammatory and Infectious Diarrhoea
- ❖ Diarrhoea Associated with Deranged Motility

Osmotic Diarrhoea

Absorption of water in the intestines is dependent on adequate absorption of solutes. If excessive amounts of solutes are retained in the intestinal lumen, water will not be absorbed and diarrhea will result. Osmotic diarrhea typically results from one of two situations:

- *Ingestion of a poorly absorbed substrate:* The offending molecule is usually a carbohydrate or divalent ion. Common examples include mannitol or sorbitol, epson salt ($MgSO_4$) and some antacids ($MgOH_2$).
- *Mal absorption:* Inability to absorb certain carbohydrates is the most common deficit in this category of diarrhea, but it can result virtually any type of mal absorption. A common example of mal absorption is lactose intolerance resulting from a deficiency in the brush border enzyme lactase. In such cases, a moderate quantity of lactose is consumed (usually as milk), but the intestinal epithelium is deficient in lactase, and lactose cannot be effectively hydrolyzed into glucose and galactose for absorption. The osmotically-active lactose is retained in the intestinal lumen, where it "holds" water. To add insult to injury, the unabsorbed lactose passes into the large intestine where it is fermented by colonic bacteria, resulting in production of excessive gas.

A distinguishing feature of osmotic diarrhoea is, it stops after the patient is fasted or stops consuming the poorly absorbed solute.

Secretory Diarrhoea

Large volumes of water are normally secreted into the small intestinal lumen, but a large majority of this water is efficiently absorbed before reaching the large intestine. Diarrhoea occurs when secretion of water into the intestinal lumen exceeds absorption. Many millions of children have died of the secretory diarrhoea associated with cholera. The responsible organism, *Vibrio cholerae*, produces cholera toxin, which strongly activates adenylyl cyclase, causing a prolonged increase in intracellular concentration of cyclic AMP within crypt enterocytes. This change results in prolonged opening of the

chloride channels that are instrumental in secretion of water from the crypts, allowing uncontrolled secretion of water. Additionally, cholera toxin affects the enteric nervous system, resulting in an independent stimulus of secretion.

Exposures to toxins from several other types of bacteria (e.g. E. coli heat-labile toxin) induce the same series of steps and massive secretory diarrhoea that is often lethal unless the child is aggressively treated to maintain hydration. In most cases, secretory diarrhoeas will not resolve during a 2-3 day fast.

Inflammatory and Infectious Diarrhoea

The epithelium of the digestive tube is protected from insult by a number of mechanisms constituting the gastrointestinal barrier, but like many barriers, it can be breached. Disruption of the epithelium of the intestine due to microbial or viral pathogens is a very common cause of diarrhea in all species. Destruction of the epithelium results not only in exudation of serum and blood into the lumen but often is associated with widespread destruction of absorptive epithelium. In such cases, absorption of water occurs very inefficiently and diarrhoea results.

The immune response to inflammatory conditions in the bowel contributes substantively to development of diarrhea. Activation of white blood cells leads them to secrete inflammatory mediators and cytokines which can stimulate secretion, in effect imposing a secretory component on top of an inflammatory diarrhea. Reactive oxygen species from leukocytes can damage or kill intestinal epithelial cells, which are replaced with immature cells that typically are deficient in the brush border enzymes and transporters necessary for absorption of nutrients and water. In this way, components of an osmotic (mal absorption) diarrhea are added to the problem.

Diarrhoea Associated with Deranged Motility

In order for nutrients and water to be efficiently absorbed, the intestinal contents must be adequately exposed to the mucosal epithelium and retained long enough to allow absorption. Disorders in motility than accelerate transit time could decrease absorption, resulting in diarrhea even if the absorptive process per se was proceeding properly. Alterations in intestinal motility (usually increased propulsion) are observed in many types of diarrhea. What is not usually clear, and very difficult to demonstrate, is whether primary alterations in motility are actually the cause of diarrhea or simply an effect.

As stated in nursing care plan (2011) The pathophysiology of diarrhoea has shown in figure-3 below,

http://nursing-care-plan.blogspot.in/2011/11/ nursing-care-plan-for-children-with.html

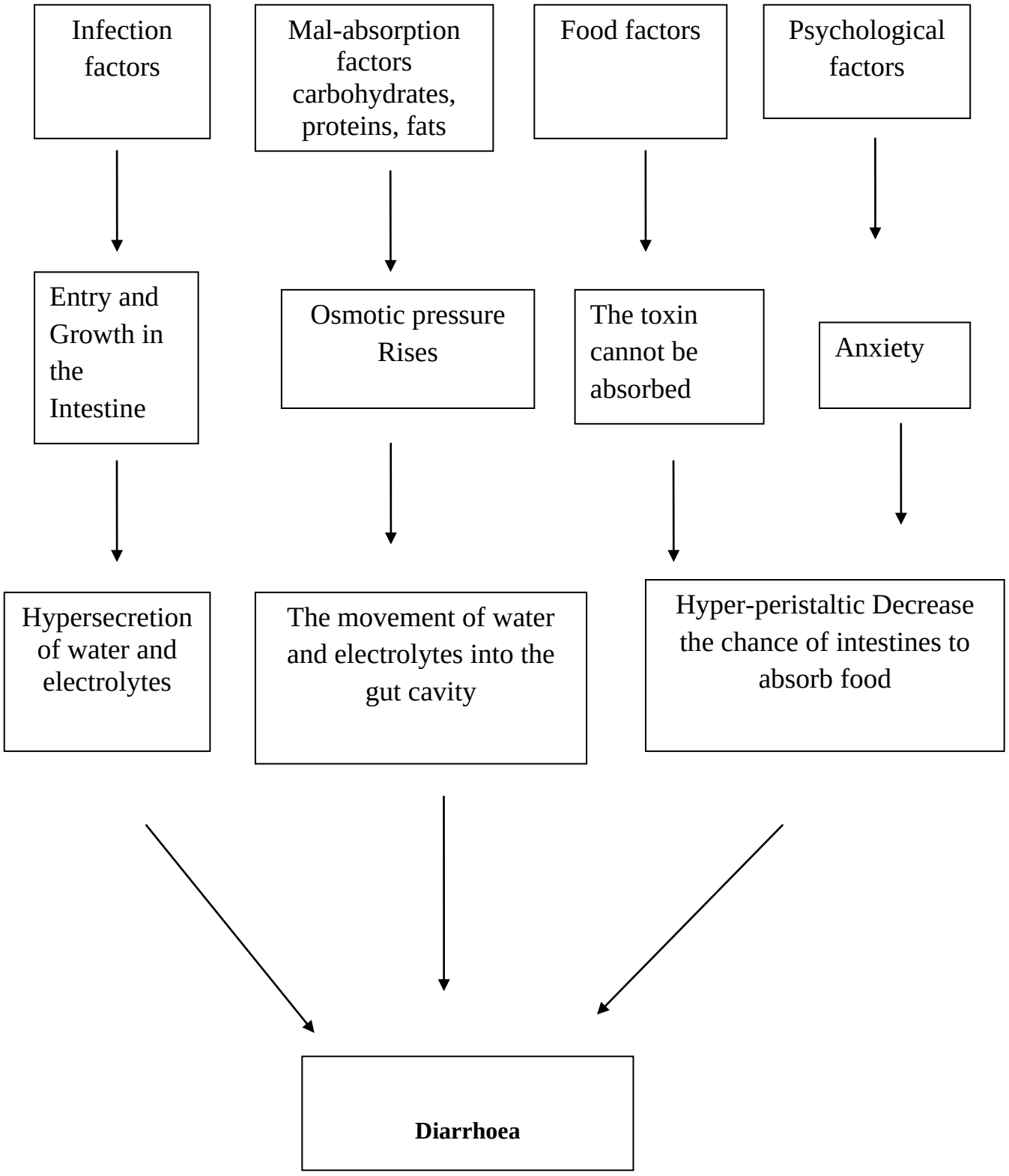

Figure. 3. Pathophysiology of diarrhoea

d. Literature related to signs and symptoms of diarrhoea

CLINICAL FEATURES:

Although the diagnosis of diarrhoea is usually made by the mother, an assessment of clinical features is essential. These will include the degree of dehydration, other indicators of severity and features which may suggest the most likely aetiological agent. The assessment of patients with diarrhoeal disease should normally follow the classical pattern of history taking, physical examination and laboratory investigations.

Signs and symptoms

- Frequent, loose, watery stools
- Diarrhoea and vomiting at the same time
- Abdominal cramps
- Abdominal pain
- Fever
- Blood in the stool
- Bloating

Stephen Murphy et al (April 2009) stated in National institute for Health and Care excellence - (NICE) a clinical guideline for diarrhoea and vomiting in children that assessment of dehydration is based on the following table.

Increasing severity of dehydration	→	→	
	No clinically detectable dehydration	**Clinical dehydration**	**Clinical shock**
Symptoms (remote and face-to-face assessments)	Appears well	**Red flag** Appears to be unwell or deteriorating	
	Alert and responsive	**Red flag** Altered responsiveness (for example, irritable, lethargic)	Decreased level Of consciousness
	Normal urine output	Decreased urine output	
	Skin colour unchanged	Skin colour unchanged	Pale or mottled skin
	Warm extremities	Warm extremities	Cold extremities
Signs (face-to-face Assessments)	Alert and Responsive	**Red flag** Altered responsiveness (for example, irritable, lethargic)	Decreased level Of consciousness
	Skin colour unchanged	Skin colour unchanged	Pale or mottled skin
	Warm extremities	Warm extremities	cold extremities
	Eyes not sunken	**Red flag** Sunken eyes	_
	Moist mucous membranes (except after a drink)	Dry mucous membranes (except for 'mouth breather')	_
	Normal heart rate	**Red flag** Tachycardia	Tachycardia
	Normal breathing pattern	**Red flag** Tachypnoea	Tachypnoea
	Normal peripheral pulses	Normal peripheral pulses	Weak peripheral pulses
	Normal capillary refill time	Normal capillary refill time	Prolonged capillary refill time
	Normal skin turgor	**Red flag** Reduced skin turgor	_
	Normal blood pressure	Normal blood pressure	Hypotension (decompensated Shock)

Suspect hyper-natraemic dehydration if there are any of the following:

- Jittery movements
- Increased muscle tone
- Hyperreflexia
- Convulsions
- Drowsiness or coma.

Lamberti, Fischer Walker and Black (2012), conducted a systematic review as guided by Department of International Health, Johns Hopkins Bloomberg School of Public Health to generate estimates of duration and severity outcomes for individuals 0-59 mos, 5-15 yrs, and ≥ 16 yrs, and for 3 severity indexes: mild, moderate, and severe. They estimated that among children under-five, 64.8% of diarrheal episodes are mild, 34.7% are moderate, and 0.5% are severe. On average, mild episodes last 4.3 days, and severe episodes last 8.4 days and cause dehydration in 84.6% of cases. Among individuals ≥ 16 yrs, severe episodes typically last 2.6 days and cause dehydration in 92.8% of cases. Moderate and severe episodes constitute a substantial portion of the total envelope of diarrhoea among children under-five (35.2%; about 588 million episodes). The absolute number of such episodes is noteworthy (about 21.5 million episodes among individuals ≥ 16 yrs). Hence, the global burden of diarrhea consists of significant morbidity, extending beyond episodes progressing to death.

e) Literature related to diagnostic evaluation in children with diarrhoea

Stephen Murphy et al (April 2009) stated in national institute for health and care excellence (NICE) that during diarrhoea do not routinely perform blood biochemical

testing. Measure plasma sodium, potassium, urea, creatinine and glucose concentrations if:

- Intravenous fluid therapy is required
- There are symptoms and/or signs that suggest hypernatraemia.

Measure acid–base status and chloride concentration in blood if shock is suspected or confirmed.

- There is no value in routinely testing the stools of infants for pH or reducing substances. Such tests are

Over sensitive, often indicating impaired absorption of lactose when it is not clinically important. It is more important to monitor the child's clinical response (e.g. weight gain, general improvement). Milk intolerance is only clinically important when milk feeding causes a prompt increase in stool volume and a return or worsening of the signs of dehydration, often with loss of weight.

Consider performing stool microbiological investigations if:

- The child has recently been abroad or
- The diarrhoea has not improved by day 7 or
- There is uncertainty about the diagnosis of gastroenteritis.

Perform stool microbiological investigations if:

- You suspect septicaemia **or**
- There is blood and/or mucus in the stool **or**
- The child is immune-compromised.

Perform a blood culture if giving antibiotic therapy.

g) Literature related to management of diarrhoea in children

As stated by Caleb et al,(2003) ORT encompasses two phases of treatment: 1) a rehydration phase, in which water and electrolytes are administered as oral rehydration solution (ORS) to replace existing losses, and 2) a maintenance phase, which includes both replacement of ongoing fluid and electrolyte losses and adequate dietary intake. Although ORT implies rehydration alone, the definition used in this report has been broadened to include maintenance fluid therapy and appropriate nutrition.

Nikhil, Sanderson (2004) published a review an interface between developing and developed countries, Oral rehydration therapies are the mainstay of management of gastroenteritis, and their composition continues to improve. Malnutrition remains the major adverse prognostic indicator for diarrhoea related mortality, emphasising the importance of nutrition in early management. Drugs are of little use, except for specific indications although new agents that target mechanisms of secretory diarrhoea show promise, as do probiotics.

According to WHO treatment guideline (2005)

Treatment Plan A: home therapy to prevent dehydration and malnutrition

Children with no signs of dehydration need extra fluids and salt to replace their losses of water and electrolytes due to diarrhoea. If these are not given, signs of dehydration may develop.

Mothers should be taught how to prevent dehydration at home by giving the child more fluid than usual, how to prevent malnutrition by continuing to feed the child, and why these actions are important. They should also know what signs indicate that the child

should be taken to a health worker. These steps are summarized in **the *four rules of Treatment Plan.***

Rule 1: Give the child more fluids than usual, to prevent dehydration

What fluids to give:

Many countries have designated recommended home fluids. Wherever possible, these should include at least one fluid that normally contains salt. Plain clean water should also be given. Other fluids should be recommended that are frequently given to children in the area, that mothers consider acceptable for children with diarrhoea, and that mothers would be likely to give in increased amounts when advised to do so.

Suitable fluids

Most fluids that a child normally takes can be used. It is helpful to divide suitable fluids into two groups:

Fluids that normally contain salt, such as:

- ORS solution
- Salted drinks (e.g. salted rice water or a salted yoghurt drink)
- Vegetable or chicken soup with salt.

Teaching mothers to add salt (about 3g/l) to an unsalted drink or soup during diarrhoea is also possible, but requires a sustained educational effort.

A home-made solution containing 3g/l of table salt (one level teaspoonful) and 18g/l of common sugar (sucrose) is effective but is not generally recommended because the recipe is often forgotten, the ingredients may not be available or too little may be given.

Fluids that do not contain salt, such as:

- Plain water

- Water in which a cereal has been cooked (e.g. unsalted rice water)
- Unsalted soup
- Yoghurt drinks without salt
- Green coconut water
- Weak tea (unsweetened)
- Unsweetened fresh fruit juice.

Unsuitable fluids

A few fluids are potentially dangerous and should be avoided during diarrhoea. Especially important are drinks sweetened with sugar, which can cause osmotic diarrhoea and hypernatraemia. Some examples are:

- Commercial carbonated beverages
- Commercial fruit juices
- Sweetened tea.
- Other fluids to avoid are those with stimulant, diuretic or purgative effects, for example:
    - Coffee
    - Some medicinal teas or infusions.

How much fluid to give:

The general rule is: give as much fluid as the child or adult wants until diarrhoea stops. As a guide, after each loose stool, give:

- ❖ children under 2 years of age: 50-100 ml (a quarter to half a large cup) of fluid;
    - children aged 2 up to 10 years: 100-200 ml (a half to one large cup);
    - Older children and adults: as much fluid as they want.

Rule 2: Give supplemental zinc (10 - 20 mg) to the child, every day for 10 to 14 days

Zinc can be given as syrup or as dispersible tablets, whichever formulation is available and affordable. By giving zinc as soon as diarrhoea starts, the duration and severity of the episode as well as the risk of dehydration will be reduced. By continuing zinc supplementation for 10 to 14 days, the zinc lost during diarrhoea is fully replaced and the risk of the child having new episodes of diarrhoea in the following 2 to 3 months is reduced.

Rule 3: Continue to feed the child, to prevent malnutrition

The infant usual diet should be continued during diarrhoea and increased afterwards. Food should *never* be withheld and the child's usual foods should *not* be diluted. Breastfeeding should *always* be continued. The aim is to give as much nutrient rich food as the child will accept. Most children with watery diarrhoea regain their appetite after dehydration is corrected, whereas those with bloody diarrhoea often eat poorly until the illness resolves. These children should be encouraged to resume normal feeding as soon as possible. When food is given, sufficient nutrients are usually absorbed to support continued growth and weight gain.

Continued feeding also speeds the recovery of normal intestinal function, including the ability to digest and absorb various nutrients. In contrast, children whose food is restricted or diluted lose weight, have diarrhoea of longer duration, and recover intestinal function more slowly.

What foods to give:

This depends on the child's age, food preferences and pre-illness feeding pattern; cultural practices are also important. *In general, foods suitable for a child with diarrhoea are the same as those required by healthy children*.

Specific recommendations are given below.

Milk

- *Infants of any age who are breastfed* should be allowed to breastfeed as often and as long as they want. Infants will often breastfeed more than usual; this should be encouraged.
- *Infants who are not breastfed* should be given their usual milk feed (or formula) at least every three hours, if possible by cup. Special commercial formulas advertised for use in diarrhoea are expensive and unnecessary; they should *not* be given routinely. Clinically significant milk intolerance is rarely a problem.

Other foods

If the child is at least 6 months old or is already taking soft foods, he or she should be given cereals, vegetables and other foods, in addition to milk.

Recommended foods should be culturally acceptable, readily available, have a high content of energy and provide adequate amounts of essential micronutrients. They should be well cooked, and mashed or ground to make the measy to digest; fermented foods are also easy to digest. Milk should be mixed with a cereal. Foods rich in potassium, such as bananas, green coconut water and fresh fruit juice are beneficial.

Rule 4: Take the child to a health worker if there are signs of dehydration or other problems

The mother should take her child to a health worker if the child:

- Starts to pass many watery stools;
- Has repeated vomiting;
- Becomes very thirsty;
- Is eating or drinking poorly;
- Develops a fever;
- Has blood in the stool; or
- The child does not get better in three days.

Treatment Plan B: oral rehydration therapy for children with some dehydration

Children with some dehydration should receive oral rehydration therapy (ORT) with ORS solution in a health facility following Treatment Plan B, as described below. Children with some dehydration should also receive zinc supplementation.

ORS solution

Use Table 2 to estimate the amount of ORS solution needed for rehydration. If the child's weight is known, this should be used to determine the *approximate* amount of solution needed. The amount may also be estimated by multiplying the child's weight in kg and 75 ml. If the child's weight is not known, select the approximate amount according to the child's age.

Table 2: Guidelines for treating children and adults with some dehydration

Approximate amount of ors solution to give in the first 4 hours

Age	Less than 4 months	4-11 months	12-23 months	2-4 yrs	5-14 yrs	15 yrs or older
Weight	Less than 5 kg	5-7.9 kg	8-10.9 kg	11-15.9 kg	16-29.9 kg	30 kg or more
In ml	200-400	400-600	600-800	800-1200	1200-2200	2200-4000

The *exact* amount of solution required will depend on the child's dehydration status. Children with more marked signs of dehydration, or who continue to pass frequent watery stools, will require more solution than those with less marked signs or who are not passing frequent stools.

Treatment Plan C: for patients with severe dehydration

Guidelines for intravenous rehydration

The preferred treatment for children with severe dehydration is rapid intravenous rehydration, following Treatment Plan C. If possible, the child should be admitted to hospital. Guidelines for intravenous rehydration are given in Table 3.

Children, who can drink, even poorly, should be given ORS solution by mouth until the IV drip is running. In addition, *all* children should start to receive some ORS solution (about 5 ml/kg/h) when they can drink without difficulty, which is usually within 3-4 hours (for infants) or 1-2 hours (for older patients). This provides additional base and potassium, which may not be adequately supplied by the IV fluid.

Table 3: Guidelines for intravenous treatment of children and adults with severe dehydration

Start IV fluids immediately. If the patient can drink, give ORS by mouth until the drip is set up. Give 100 ml/kg

Ringer's Lactate Solution divided as follows:

Age	First give 30 ml/kg in	Then give 70ml/kg in
Infants (under 12 months)	1 hour	5 hours
Older	30 minutes	2 ½ hours

- Reassess the patient every 1-2 hours. If hydration is not improving, give the IV drip more rapidly.
- After six hours (infants) or three hours (older patients), evaluate the patient using the assessment chart. Then choose the appropriate Treatment Plan (A, B or C) to continue treatment.

A. If Ringer's Lactate Solution is not available, normal saline may be used.

B. Repeat once if radial pulse is still very weak or not detectable.

Monitoring the progress of intravenous rehydration

Patients should be reassessed every 15-30 minutes until a strong radial pulse is present. Thereafter, they should be reassessed at least every hour to confirm that hydration is improving. If it is not, the IV drip should be given more rapidly.

When the planned amount of IV fluid has been given (after three hours for older patients, or six hours for infants), the child's hydration status should be reassessed.

Diarrhea Complications

- Severe dehydration and acid-base derangements with acidosis
- Shock

Nursing management

Assessment of Diarrhoea

- Obtain accurate history of signs and symptoms: nature and frequency of stools, type of onset, length of illness, associated symptoms.
- Assess degree of dehydration.
- Monitor intake and output including oral and I.V. fluids, fluid loss from diarrhea, urine output, and vomitus; monitor weight
- Note color and consistency of stool and vomitus.

Nursing Interventions in Diarrhea

Restoring Fluid Balance

- Monitor amount and rate of I.V. fluid therapy, which have been calculated by the health care provider. Fluid needs are based on fluid deficit, ongoing losses, and body weight.
- Prevent overload of circulatory system.
- Check flow rate and amount absorbed hourly and totally.
- Adhere to prescribed volume carefully when oral feedings are given in conjunction with I.V. fluid.
- Never administer I.V. fluids to pediatric patient without safeguard of a volume-control infusion device or pump.
- Observe for signs of fluid overload: edema, increased BP, bounding pulse, labored respirations, and crackles in lung fields.

 Check I.V. site for infiltration or improper flow so site can be changed as necessary.

 Use appropriate protective devices to prevent the child from injuring involved extremity or causing I.V. to malfunction.

 Weigh the patient daily as a guide for fluid needs and patient status.

 Monitor urine output and keep accurate intake and output record, including vomitus and liquid stools.

 If NPO, provide frequent mouth care and nonnutritive sucking with a pacifier. Continue to bubble infant to expel air swallowed while crying or sucking.

 If oral rehydration solution is used, reassess hydration status every 2 to 4 hours, once rehydrated, continue for 8 to 12 hours, then resume breast-feeding with increased frequency of feedings or formula at full strength or increased frequency if half strength.

World health organization (2011) explains that the provision of safe water alone will reduce diarrhoeal and enteric disease by up to 50%, even in the absence of improved sanitation or other hygiene measures. WHO further asserts that there is now conclusive evidence that simple, low cost interventions which are capable of eliminating harmful viruses from household stored water can reduce the risks of diarrhoeal disease for people of all ages in both the developed and the developing world.

Christa Walker and Robert Black, (2011), conducted a study on Rotavirus vaccine and diarrhea mortality: quantifying regional variation in effect size, they reviewed published vaccine efficacy trials to estimate a regional-specific effect of vaccine efficacy on severe rotavirus diarrhea and hospitalizations. They assessed the quality of evidence using a standard protocol and conducted meta-analyses where more than 1 data point was available. Rotavirus vaccine prevented severe rotavirus episodes in all regions; 81% of

episodes in Latin America, 42.7% of episodes in high-mortality Asia, 50% of episodes in sub-Saharan Africa, 88% of episodes low-mortality Asia and North Africa, and 91% of episodes in developed countries. They concluded that Vaccine trials have not measured the effect of vaccine on diarrhea mortality. The overall quality of the evidence and consistency observed across studies suggests that estimating mortality based on a severe morbidity reduction is highly plausible.

11. LITERATURE RELATED TO ORAL REHYDRATION SOLUTION IN DIARRHOEAL MANAGEMENT

According to Nikhil Thapar, Ian R Sanderson (2004) ORT was probably the greatest medical innovation of the 20th century, providing an example of the transfer of technology from developing to developed countries. ORT solutions contain specific concentrations of sodium, glucose, potassium, chloride, and alkali (bicarbonate or citrate) in water. The rationale for this treatment stems from the observation that in most causes of acute infectious diarrhoea, including cholera, the coupled transport of sodium to glucose or other solutes is largely unaffected. By the 1970s, studies that showed the value of ORT in children with acute diarrhoea of varying causes, led WHO to recommend its use for diarrhoea of any cause in all age-groups.

ORT composition

According to European Society of Paediatric Gastroenterology and Nutrition (2010) ORT concentrations were derived to promote optimum co-transport of sodium by presenting equimolar concentrations of sodium and glucose, and to ensure adequate replacement of potassium, chloride, and bicarbonate. The initial formulations, based on work with cholera patients, contained 90 mmol/L of sodium with an osmolarity of 310

mOsm/L. Concern that such formulations might be inappropriate for all forms of acute diarrhoea, especially in developed countries where water and electrolyte losses and malnutrition were unlikely to be of the same order as that seen in developing countries, prompted (ESPGAN) to recommend a 60 mmol/L sodium, hypoosmolar solution. Hahn and colleagues conducted the meta-analysis of studies of reduced osmolarity ORT solutions, showed that children who were admitted to hospital and received reduced osmolarity ORT had reduced stool output, less vomiting, and less need for intravenous infusions than did those who had the standard WHO solution, with no significant difference in the rate of hyponatraemia.

Determinants of ORS use in children under five years with diarrhoea

Socio demographic factors

According to WHO/UNICEF (2009), boys and girls were equally likely to receive ORS solution to treat diarrhoea. Children in urban areas (39%) were more likely to receive ORS solution than those living in rural areas (31%). Similarly, children from the wealthiest families were 1.5 times as likely to receive ORS to treat their diarrhoea as the poorest children.

A study conducted by Mac Donald et al (2007), in Pakistan on ORS solution use found that, maternal education was related to the level of utilization of health services, with 55% of children with diarrhoea whose mother had no schooling or incomplete primary school, being taken for treatment, compared with 95% children whose mothers had completed secondary schooling or higher. In addition, residence was strongly related to the use of health services. Thirty two percent of children in rural residence were taken for treatment in comparison to 75% of children in urban residence. However, the same

study found out that, there was no significant difference in the proportion of girls (72%) or boys (68%) who were taken to health care services for treatment. Furthermore, there was no clear, age-specific pattern to seeking treatment, although there was a tendency for a higher proportion (83%) of children aged 12 to 23 months to use health care facilities.

The findings of the Uganda Demographic Health Survey (UDHS, 2006) showed that, young children ages 6 – 23 months were more prone to diarrhoea than children in the other age groups. There were no variations in the prevalence of diarrhoea by child's sex.

According to Meyers et al (2003) barriers to utilization of ORS solution also confirmed that, urban and more educated women had greater exposure than do rural and less educated women. Muslim women in particular have been found to have lower exposure than do women belonging to other religious denominations.

Mathuram santosham et al (2010) conducted a study to find out the progress and barriers for the control of diarrhoeal disease. In this study they summarized that discovery of intestinal sodium-glucose transport was the basis for development of oral rehydration solution, and hailed as potentially the most important medical advance of the 20th century. Before widespread use of oral rehydration solution, treatment for diarrhoea was restricted to intravenous fluid replacement, for which patients had to go to a health-care facility to access appropriate equipment. These facilities were usually neither available nor reasonable to use in the resource-poor settings most affected by diarrhoea. Use of oral rehydration solution has stagnated, despite being effective, inexpensive, and widely available. Thus, diarrhoea continues to be a leading cause of child death with consistent mortality rates during the past 5 years. New methods for prevention, management, and

treatment of diarrhoea-including an improved oral rehydration formulation, zinc supplementation, and rotavirus vaccines-make now the time to revitalise efforts to reduce diarrhoea mortality worldwide.

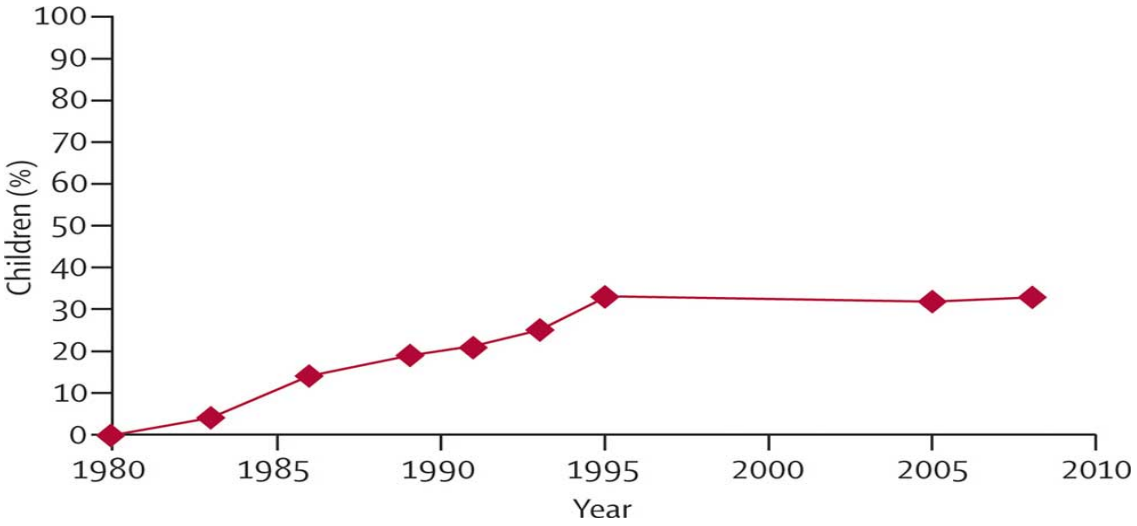

Fig. 4 Global percentage of children younger than 5 years with diarrhoea who received oral rehydration solution

Anita Sharma, Ramesh Kumar (2004) conducted a study on efficacy of WHO-ORS in malnourished children with acute dehydrating diarrhoea in Rohtak. Twenty-five well nourished children (group A) and 25 malnourished children (group B) of acute diarrhoea with some dehydration were taken up for the study. Both the groups were given World Health Organization-oral rehydration solution (WHO-ORS) as per WHO guidelines. In both the groups, isonatraemic dehydration was the commonest (group A 64%, group B 56%). Hypokalaemia was noted in 32% cases in group A and 60% cases in group B. Oral rehydration therapy (ORT) was successful in 92% cases in well nourished group A cases and in 80% in group B cases. The mean time in hours required for

hydration (group A 8.1+/-1.6; group B 9.1+/-1.4; $p<0.05$) and hospital stay in days (group A 1.6+/-0.9; group B 3.2+/-3.3; $p<0.05$) were longer in group B.

Although Oral Rehydration Therapy (ORT) and specifically ORS were introduced in India in the 1980s, approximately 500,000 children still died each year from dehydration due to diarrhea. Most of these diarrhea related deaths could be prevented with the use of ORT.

According to the National Family Health Survey 1998-99 (NFHS) although the awareness of ORS stood at 62 per cent nationally, usage was only 27 per cent. The situation in North India was even worse where diarrhea prevalence and childhood mortality rates were higher but ORS usage rates stood at just 20 per cent and almost 52 per cent used mostly inappropriate medicines. Approximately 63 per cent (NFHS) of households where children had diarrhea sought treatment from private healthcare practitioners and that too mostly from less than fully qualified or traditional healthcare providers or Indigenous Systems of Medicine Practitioners (ISMPs).

	North India (Project Area)	All India
Diarrhea among children <3	22%	19%
Awareness of ORS among caregivers	52%	62%
Use of ORS	20%	27%
Use of homemade solution Pill or syrup	2%	3%
or injection used	52%	53%
No treatment	33%	27%

National ORS Day was established on July 29th, (2001) as a day to motivate doctors to commit to prescribing WHO ORS to treat diarrhea. This was chosen as an appropriate date as it is the peak of monsoon season in North India as well as the time

when there is a sharp increase in the number of diarrhea cases. Throughout the years ORS Day has grown and gained prominence and recognition from the government, industry and from the medical community with numerous events organized by various partners and Hamjoli Field teams supported by local chapters of Indian Academy of Pediatrics.

Maulen Gutierrez and Hashem (2004) conducted a study to assess the "safety and efficacy of premixed, rice based oral rehydration solution". The authors compared the safely and efficacy of ready-to-use, premixed, rice based oral rehydration solution(R-ORS) with a glucose-based oral rehydration solution (G-ORS) in Mexican children with acute diarrhoea for less than five days. 189 boys aged 3-24 month admitted to the hospital with acute diarrhoea receive ether G-ORS or R-ORS. Intake and output were measured every 3 hours. In the group treated with R-ORS, significantly fewer patients required supplemental intravenous fluid during the rehydration phase compared to the G-ORS group (1% v 8.7%; $p<0.01$) mean stool output, percent weight gain, ORS intake, urine output and number of patients who vomited during rehydration were similar in the two groups. The mean stool output after the first 24 hours of maintenance phase was significantly lower in the R-ORS group than in the G-ORS group. The rice based ORS is safe, and its use reduced the rate of intravenous fluid therapy in comparison with the use of glucose-based ORS.

Umapathi (2005) conducted an experimental study was conducted to examine the effectiveness of oral rehydration therapy in association with the dehydration status among 30 children one month to 5 yrs with moderate dehydration admitted with acute diarrhea in civil hospital, Raichur. The study findings showed that the subjects 93.33% children were

rehydrated within 4 hrs. The study concluded that the significant relationship was found between oral rehydration therapy and rehydration.

Melinda et al (2010) conducted a study to find out the effect of oral rehydration solution and recommended home fluids (RHFs) on diarrhoea mortality in Baltimore, USA. They conducted a systematic review to identify studies evaluating the efficacy and effectiveness of ORS and RHFs and abstracted study characteristics and outcome measures into standardized tables. They identified 205 papers for abstraction, of which 157 were included in the meta-analyses of ORS outcomes and 12 were included in the meta-analyses of RHF outcomes. They estimated that ORS may prevent 93% of diarrhoea deaths and also they concluded that ORS is effective against diarrhoea mortality in home, community and facility settings.

III.LITERATURE REVIEW RELATED TO LOW-OSMOLARITY ORS

Composition of oral rehydration salts

As stated in Essential medicines and health products information portal-a world health organization resource (2013) for more than 20 years, WHO and UNICEF have recommended this single formulation of ORS to prevent or treat dehydration from diarrhoea irrespective of the cause or age group affected. This product, which provides a solution containing 90 mEq/l of sodium with a total osmolarity of 311 mOsm/l,has proven effective and without apparent adverse effects in worldwide use. It has contributed substantially to the dramatic global reduction in mortality from diarrhoeal disease during the period. During this period, numerous studies have been undertaken to develop an “improved” ORS. The goal was a product that would be at least as safe and effective as standard ORS for preventing or treating dehydration from all types of

diarrhoea but which, in addition, would reduce stool output or have other important clinical benefits. One approach has consisted in reducing the osmolarity of ORS solution to avoid possible adverse effects of hypertonicity on net fluid absorption. This was done by reducing the solution's glucose and salt (NaCl) concentrations. http:// apps. who. int/ medicine docs/en/d/Js4950e/2.4.html

According to world health organization (2004) the reduced osmolarity ORS containing 75 mEq/l sodium, 75 mmol/l glucose (total osmolarity of 245 mosm/l) is as effective as standard ORS in adults with cholera. However, it is some time associated with an increased incidence of transient, asymptomatic hyponatraemia. Because of the improved effectiveness of reduced osmolarity ORS solution, WHO and UNICEF now recommend that countries use and manufacture, for diarrhoea of all etiologies and in all age groups, the following formulation with a total osmolarity of 245 mOsmol/l, in place of the previously recommended ORS solution with a total osmolarity of 311 mosm/l. It should be emphasized that the new ORS is considered as a medicine, like the old formulation, and has been included in the WHO model list of Essential Medicines. Therefore, it should be manufactured as a pharmaceutical product, following all the requirements of the Good Manufacturing Practices.

Composition of ORS	Old standard ORS (1975)	New low-osmolarity ORS (2002)
Glucose (mM)	110	75
Sodium (mM)	90	75
Chloride (mM)	80	65
Potassium (mM)	20	20
Citrate (mM)	10	10
Total Omolarity (mOsM)	**310**	**245**

This ORS composition has passed extensive clinical evaluations and stability tests. The pharmacokinetics and therapeutic values of the substances are as follows:

- Glucose facilitates the absorption of sodium (and hence water) on a 1:1 molar basis in the small intestine;
- Sodium and potassium are needed to replace the body losses of these essential ions during diarrhoea (and vomiting);
- Citrate corrects the acidosis that occurs as a result of diarrhoea and dehydration.

Low-osmolarity ORS has been shown to reduce stool volume output and vomiting by 25% and 30% respectively compared to the original formula of ORS. Low-osmolarity ORS also reduces the need for unscheduled intravenous (IV) fluids in young children and the duration of diarrhoea by 33%. The use of I.V. fluids implies the need for hospitalization with all its increased costs to the health care system as well as potential risks to the patient.

According to rehydration project (2013) the study results clearly describe the advantages of this new reduced osmolarity ORS solution in treating children with acute diarrhea:

- It reduces stool output or stool volume by about 25% when compared to the original WHO UNICEF ORS solution,
- It reduces vomiting by almost 30%.
- It reduces the need for unscheduled IV therapy by more than 30%.

Thermiany Sundari et al (2009) conducted a study to evaluate the Efficacy of reduced osmolarity oral rehydration solution, rice-based oral rehydration solution, and standard WHO oral rehydration solution in children with acute diarrhoea. A randomized open trial was conducted in children aged 6-59 months old admitted for acute diarrhoea.. The mean duration of diarrhea was significantly lower in the group treated with reduced osmolarity ORS (52.66 h,95% cl 47.13 to 58.18) and rice based ors(54.66 h,95% cl 47.97 to 61.34)compared to the group treated with the WHO standard ORS (67.34 h,95% cl 61.50 to 73.18). Multivariate analysis shows that intervention had a significant effect on reducing the duration of diarrhea. The study has concluded that reduced osmolarity ORS and rice-based ORS significantly lower the mean duration of children with acute diarrhea compared with the group treated with the WHO standard ORS.

IV. LITERATURE REVIEW RELATED TO WHO-ORS WITH ZINC IN MANAGEMENT OF DIARRHOEA.

Patel and Dhandeand Rawat (2005) conducted a study to test the hypothesis that daily supplementation of zinc and copper mixed with the oral rehydration solution (ORS) reduces the duration and the severity of acute diarrhea in children in Nagpur, Maharashtra, India. In a randomized, double blind, placebo controlled trial children aged 6 months to 59 months in an urban hospital with acute diarrhea, were assigned to receive the intervention of once daily 40 mg of zinc sulfate and 5 mg of copper sulfate dissolved

in a liter of standard ORS (n = 102) or placebo (50 mg of standard ORS powder) dissolved in a liter of ORS. This study showed that the most important predictor for duration of diarrhea in children was the severity of the disease at enrollment, and, not the supplementation.

Gregorio et al (2007) conducted a comparative study to determine whether zinc with oral rehydration solution (ORS) is more cost effective than ORS alone in the treatment of acute diarrhea in Manila, Philippines. Cost of treatment and outcome of participants of a randomized trial of zinc+ORS vs. ORS alone for acute diarrhea were investigated. Subjects were 2-59 months children with diarrhea <7 days and no dehydration. The direct medical, nonmedical and indirect costs were obtained, using the societal perspective. The incremental cost-effectiveness ratio (ICER) was calculated. Sixty patients were given zinc+ORS and 57 were given ORS alone. Mean duration of diarrhoea was 17 hours shorter and mean total cost of treatment was 5% cheaper in the zinc than ORS group. The ICER showed that with use of zinc, the society saves $ 2.4 per day of diarrhea <4 days and spends $ 0.03 per case of diarrhea averted <4 days from consult, although the confidence interval included the null value of zero. They concluded that the use of zinc with ORS reduced the total cost and duration of acute diarrhea.

As reported by Emily White Johansson et al (2009) in UNICEF Headquarters a new strategy for diarrhoea control drawn. It sets out a 7-point plan that includes a treatment package to reduce childhood diarrhoea deaths, as well as a prevention package to make a lasting reduction in the diarrhoea burden in the medium to long term.

The diarrhea management campaign was initiated by ICICI Bank (2002) under the bilateral Program for Advancement of Commercial Technology -Child and

Reproductive Health (PACT-CRH) between the Government of India (GOI) and United States Agency for International Development (USAID). This campaign evolved significantly during its lifetime. Initially it focused on promoting the use of WHO formulation Oral Rehydration Solution (ORS). In 2005, after supporting policy advocacy for a shift to a new formulation, the program helped in smooth transition to the reduced osmolarity ORS. From 2006 the campaign expanded into the SaathiBachpanke (Friends of Childhood) Complete Home Diarrhea Management (CHDM) campaign, and finally in 2007 the program designed and piloted communication and promotion strategies and prototypes that could be adopted by Govt. of India and private sector partners and others, for the introduction of Zinc therapy.

The Ministry of Health & Family Welfare, Government of India (2007) reviewed this recommendation and subsequently and announced its policy guidelines on the use of Zinc in the management of diarrhea for the children. The notification stated that "It has now been decided to administer Zinc in the national programme as an adjunct to ORS in the management of diarrhea in children older than three months. Introduction of Zinc in the Public Health System for diarrhea will go a long way in reducing the infant mortality rate".

Global Zinc Task Force, UNICEF (2009) stated that the Ministry of Health and UNICEF are working closely to introduce a diarrhoea treatment kit – containing both ORS and zinc tablets – through the public health system in areas with the highest diarrhoea prevalence rates in Benin. And in Madagascar, the Ministry of Health is working closely with the United States Agency for International Development and

UNICEF to pilot zinc-related diarrhoea management training in several districts at both the community and health-facility level.

The use of Zinc

According to The Child Health Epidemiology reference Group (CHERG) (2010) about 30% of the world's population is zinc deficient, most prevalent in children under 5 years of age in developing countries. Zinc deficiency is associated with impaired immune function which results in an increase in morbidity due to infections, growth retardation, hypogonadism and cognitive dysfunction. Over the past two decades, strong evidence has come forward from multiple randomized controlled trials, in both developed and developing countries, showing an effect of zinc in decreasing morbidity and mortality in children due to gastrointestinal and respiratory infections. This effect of zinc against infectious diseases is therapeutic as well as preventive. Previous reviews by the Zinc Investigators' Collaborative Group in 1999 and by Aggarwal et al have studied the effect of preventive zinc supplementation on diarrheal and respiratory morbidity. The current systematic review presents the effect of zinc supplementation on mortality in children less than 5 years of age in developing countries. The evidence for the effect of zinc supplementation on cause-specific mortality and morbidity is assessed for diarrhea, pneumonia and malaria.

As stated in India sanitation portal, UNICEF WASH program (2012) Zinc and oral rehydration salts (ORS) treatment is coming to the rescue of children under five years suffering from diarrhoea, which kills 3 lakh children each year. Dehydration, low immunity and malnutrition associated with diarrhoea results in 25-30 per cent of global diarrhoeal deaths in children under the age of five in India alone. Micronutrient Initiative,

an international non-profit organization working in the field of disease management and nutrition in developing countries, is distributing two sachets of ORS and 14 zinc tablets to children in villages through Accredited Social Health Activists (ASHA), anganwadi workers and auxiliary nurse midwives (ANMs).Giving ORS solution to children suffering from diarrhoea will only replenish water loss. To kill the infection, they need to complete a 14-day course of zinc tablets. The central health department along with Micronutrient Initiative, UNICEF and other global NGOs is coming up with national operational guidelines for treatment of childhood diarrhoea using zinc and ORS in India.

According to the UNICEF and WHO report (2012) a 7-point plan for comprehensive diarrhoea control need to control the diarrhoea in developing country.

A 7-point plan for comprehensive diarrhoea control

Treatment package

1) fluid replacement to prevent dehydration and
2) Zinc treatment.

Prevention package

The prevention package highlights five main elements that require a concerted approach in their implementation. The package includes:

3) Rotavirus and measles vaccinations,
4) Promotion of early and exclusive breastfeeding and vitamin A supplementation,
5) Promotion of hand washing with soap,
6) Improved water supply quantity and quality, including treatment and safe storage of household water, and

7) Community-wide sanitation promotion. In many countries, progress has been made in the delivery or promotion of several of these interventions, particularly vitamin A supplementation and exclusive breastfeeding.

Nirmalya Dutta (2013) stated in health India UNICEF launched a USD 5 million programme in India for providing zinc supplementation and oral rehydration therapy to children with diarrhoea. Unicef Canada and Teck, a mineral company, launched the new programme that will save over 150,000 children's lives in India. The programme aims to scale up the use of zinc supplementation and oral rehydration salts (ORS) to treat diarrhoea while strengthening health care systems across India. More children under the age of five die in India than anywhere else in the world. One of the leading causes of these deaths is diarrhoea. Currently, only 2 percent of Indian children have access to zinc and ORS, a cost effective and proven life-saving diarrhoea treatment.

Chaitali Bajait and Vijay Thawani (2011) stated that Zinc supplementation is a critical new intervention for treating diarrheal episodes in children. Recent studies suggest that administration of zinc along with new low osmolarity oral rehydration solutions / salts (ORS), can reduce the duration and severity of diarrheal episodes for up to three months. The World Health Organization (WHO) and UNICEF recommend daily 20 mg zinc supplements for 10 – 14 days for children with acute diarrhea, and 10 mg per day for infants under six months old, to curtail the severity of the episode and prevent further occurrences in the ensuing -two to three months, thereby decreasing the morbidity considerably. This article reviews the available evidence on the efficacy and safety of zinc supplementation in pediatric diarrhea and convincingly concludes that zinc supplementation has a beneficial impact on the disease outcome. Recommended dose of

zinc in diarrhea-Elemental zinc is used orally, as an adjunct to ORT in acute diarrhea, in infants (under six months): 10 mg daily for 10 – 14 days; and in children (six months - five years): 20 mg daily for 10 - 14 days. Type of zinc salt-Zinc sulfate, acetate, and gluconate are all acceptable zinc salt formulations, of which zinc sulfate is low-cost, efficacious, safe, and therefore, optimal for the national program. Zinc sulfate tablets may be dispersed in breast milk, in oral rehydration solutions, or in water on a small spoon; older children may chew the tablets or swallow them with water. Zinc sulfate dispersible tablet is also available in the market, containing 20 mg of elemental zinc. Pediatric zinc sulfate tablets are also available.

The Indian Academy of Pediatrics, WHO, and UNICEF (2011) have already endorsed the use of zinc as a supplement to ORS in the management of diarrhea. A dosage of 20 mg of elemental zinc per day has been shown to be effective and safe in age group six months - to five years. Administration of zinc is recommended through a primary healthcare.

Sarmila Mazumder et al (2006) conducted a study on effectiveness of zinc supplementation plus oral rehydration salts for diarrhoea in infants aged less than 6 months in Haryana state, India. The trial was conducted in 6 primary health centre areas in Faridabad .Outcome data were obtained by means of two cross-sectional surveys conducted 3 months (survey 2) and 6 months (survey 3) after the start of the intervention. In each of these surveys, households with children aged < 4 years were visited and caregivers were interviewed to collect information on socioeconomic factors, history of diarrhoea, cough, rapid or difficult breathing (in the preceding 24 hours and 2 weeks) and hospitalizations during the preceding 3 months. The principal findings of this subgroup

analysis in infants aged less than 6 months are the zinc supplementation plus ORS were improved the immunity as like the 1 to 4 years of age in Haryana state, India.

Christa and Robert (2010) conducted a study on "Zinc for the treatment of diarrhoea: effect on diarrhoea morbidity, mortality and incidence of future episodes." Zinc supplementation for the treatment of diarrhoea has been shown decreases the duration and severity of the diarrhoeal episode. The result shows that zinc supplementation decreased the proportion of diarrhoeal episodes which lasted beyond 7 days, risk of hospitalization and diarrhoea mortality by 23%.

Mohammad et al, (2011) conducted a literature search to identify Randomized control trials (RCTs) on zinc supplementation for greater than 3 months in children less than 5 years of age in developing countries and its effect on mortality was analyzed. The effect of preventive zinc supplementation on mortality was given in eight trials.The impact on diarrhea-specific mortality of zinc alone was a non-significant 18% reduction (RR = 0.82; 95% CI: 0.64, 1.05) and 15% for pneumonia-specific mortality (RR = 0.85; 95% CI: 0.65, 1.11). The incidence of diarrhea showed a 13% reduction with preventive zinc supplementation (RR = 0.87; 95% CI: 0.81, 0.94) and a 19% reduction in pneumonia morbidity (RR = 0.81; 95% CI: 0.73, 0.90).They, therefore, conclude that zinc supplementation in children is associated with a reduction in diarrhea mortality of 13% and pneumonia mortality of 15%.

The Integrated Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea (GAPPD), by WHO/UNICEF (April 2013) was the heart of the challenge by recognizing that the only way to combat these two preventable diseases is, not to address them separately, but fight them together in an integrated approach-- Pneumonia and diarrhoea together account for 29% of all child deaths globally, resulting in the

deaths of more than two million children each year. Children living in poor or remote communities are most at risk and evidence shows children are dying from these preventable diseases because effective interventions are not provided equitably across all communities. Countries most affected can end this staggering and unnecessary death toll. The goal is to see a drop in deaths from pneumonia to fewer than 3 children in 1000 live births, and from diarrhoea to less than 1 in 1000 by 2025.

Challenges for the future

WHO (2013) predicts that there will still be about 5 million deaths in children younger than five years by 2025. 97% of these will be in the developing world and mostly caused by infectious diseases, within which diarrhoea will continue to play a prominent part. In 1995, more than a quarter of children under the age of 5 years were malnourished, accounting for half of all deaths. Poor hygiene, sanitation, and access to safe drinking water, drive mortality even higher, representing in the developing world an unacceptable but potentially reversible struggle between life and death.

CHAPTER - III

RESEARCH METHODOLOGY

"For every piece of research works, the methodology of investigation is of vital importance. The success of any research depends upon the suitability of the method, the tools and techniques the researcher followed to gather adequate data".

-Polit, 2004

RESEARCH APPROACH

Quantitative approach was used in this study to determine the effectiveness of WHO ORS with ZINC on dehydration and stool frequency among the children with diarrhoea.

Quantitative research:

The investigation of phenomena that lend themselves to precise measurement and quantification, often involving a rigorus and controlled design.

-Polit, 2004

RESEARCH DESIGN

Quasi-experimental-Nonequivalent control group pretest-posttest design was used in this study. Quasi-experiments involve the manipulation of an independent variable to observe the effect on dependent variable, but it lacks at least one of the two characteristics of the true experimental design; randomization or a control group. The study aimed at evaluates the effectiveness of WHO-ORS with zinc on dehydration and diarrhoeal status among the children aged between 3 months to 5 years with diarrhoea. Random selection & randomization is not possible since it is impossible to have the entire

listing of children with diarrhoea, hence the researcher choose Quasi-experimental design. The research design is represented in the table below,

Groups	Measurement of dependant variable (pretest)	Manipulation of independent variable (Intervention)	Measurement of dependant variable (posttest)
I	O1	X	O2,O3,O4
II	O1	-	O2,O3,O4

Key:

I - Experimental group,

II - Control group

O1 - Assessment of dehydration and stool frequency (pre test) on both groups.

X - Intervention with WHO-ORS with zinc

O2, O3 and O4 - Assessment of dehydration and stool frequency (post test) on both groups.

Dependent variable: dehydration and stool frequency

Independent variable: WHO-ORS with zinc.

SETTING OF THE STUDY

This study was conducted among children with diarrhoea who are undergoing treatment in Government Rajaji Hospital at Madurai. It is situated at Goripalayam which is 5kms away from Sacred Heart Nursing College. The hospital was established in 1842 and converted as Teaching Hospital in 1956. It is a district head quarters hospital and 2418 bedded. It has a separate wing for pediatrics with 250 beds, which has pediatric

outpatient department, medical and surgical wards, pediatric theatre, burns unit and isolated unit for diarrhoea. It is 21 bedded diarrhoeal treatment unit. Every week 15 -20 children with diarrhoea has admitted and treated for the same in this unit with mild to severe level of dehydration.

POPULATION:

The target population of this study was the children aged 3 months to 5 years with diarrhoea admitted in diarrhoeal ward.

SAMPLES

Definition

A subset of population comprising those selected to participate in a study.

-Polit(2012)

The samples of the study were the children aged 3 months 5 yrs with acute diarrhoea who fulfill the inclusion and exclusion criteria and who have admitted in Government Rajaji Hospital during data collection period.

SAMPLE SIZE

The sample size for the study was 60 among 30 children were in experimental group and 30 children in control group.

SAMPLING TECHNIQUE

Definition

The process of selecting a portion of the population to represent the entire population.

- Polit (2012)

The consecutive sampling technique was adapted for this study.

Consecutive sampling involves recruiting all of the people from an accessible population who meet the eligibility criteria over a specific time interval, or for a specified sample size.

- Polit (2012)

Consecutive children who had admitted in the hospital during the data collection period and who had fulfilled the inclusion and exclusion criteria were selected as sample. Samples in experimental and control group were allotted based on the treatment prescription.

CRITERIA FOR SAMPLE COLLECTION

The sample was selected based on the following inclusion criteria and exclusion criteria.

INCLUSION CRITERIA:

1. Children admitted in diarrhoea ward in Government Rajaji Hospital at Madurai.
2. Children aged between 3 months to 5yrs with a history of acute diarrhea.
3. Children with <10percentage of dehydration as WHO classification
4. Both male and female children.
5. Parents of the children who are willing to participate.

EXCLUSION CRITERIA

1. Children with the history of persistent diarrhoea.
2. Children aged less than 3months.
3. Children presenting with severe dehydration and shock.
4. Children presenting with other associated illness.

RESEARCH TOOL AND TECHNIQUE

The instrument which was used for the study has three parts.

PART I:

It consists of demographic profile such as age, sex, weight on admission, duration of diarrhoea and the presence of vomiting. It also deals with demographic profile in relation to parent's literacy level, drinking water-source, sanitation, toilet facility and hand washing habit.

PART II:

This consists of world health organization observational check list. Observational checklist on dehydration was used to assess the dehydration. The validation on reliability of the tool was examined. The tool has 11 items in it. Each item was scored between 1, 2 and 3. In dehydration assessment tool, one refers to no dehydration, two refers to the some dehydration and three refers to the severe dehydration.

Score between 1-11 falls under no dehydration, between12-22 is categorized as some dehydration and 23-33 is categorized as severe dehydration.

PART III:

This consists of diarrhoeal observational check list. Observational checklist on diarrhoeal stool has used to assess the diarrhoeal stool. The validation on reliability of the tool was examined.. The tool has 8 items in it. Such as color, consistency, odour, blood, mucus, duration, and pain.

Each item was scored between 1, 2 and 3. In diarrhoeal stool assessment tool, one refers to mild changes in stool, two refer to moderate changes in stool and three refers to the severe changes in stool.

Score between 1-8 falls under mild diarrhoea, between 9-16 is categorized as moderate diarrhoea and 17-24 is categorized as severe diarrhoea.

TESTING OF THE TOOL

CONTENT VALIDITY

The content of the tool was validated by nine experts. Two from child health nursing ,one from community health nursing ,one from medical surgical nursing ,four from pediatrician (child specialist doctors) and one from statistician. The content of the tool has modified as recommended by the experts. After modification the tool has accepted by the experts.

RELIABILITY

Reliability of the tool was established by inter -rater method. The reliability of the observational checklist on dehydration was found r =0.84. The reliability of the observational checklist on diarrhoeal status was found r =0.83.The tool was found to be reliable.

INTERVENTION

The intervention for the present study was framed after wide literature review and expert opinion. Selected nursing intervention for the present study consisted of the following. Pretest was done to assess the dehydration and diarrhoea status on both groups (control and experimental group) on day one. WHO-ORS with zinc was administered to children in experimental group.

WHO Fluid Replacement or Treatment Recommendations

<table>
<tr><td rowspan="4">No dehydration</td><td rowspan="4">Oral rehydration salts</td><td colspan="2">Administer after each stool:</td></tr>
<tr><td>Age</td><td>Volume of ORS</td></tr>
<tr><td><6 months</td><td>Quarter glass or cup or 50 ml</td></tr>
<tr><td>7 months–2 years</td><td>Quarter to half glass or cup or 50 ml - 100 ml</td></tr>
<tr><td></td><td></td><td>2 - 5 years</td><td>Half glass to one glass or cup or 100 ml - 200 ml</td></tr>
<tr><td>Some dehydration</td><td>Oral rehydration salts</td><td colspan="2">75 ml/kg of ORS over a period of 4 hours.</td></tr>
</table>

The WHO ORS was diluted in one liter of boiled and cooled water. The amount of ORS has been calculated as per the table given by the WHO. Based on the assessment recalculation was done after 4hrs.It was started slowly 3-5ml in a small cup or spoon every few minutes. The amount was increased gradually if no vomiting occurs. 1 tea spoon every 2-3 min or as required by the child was given.

In this study “ZIORAL” a commercially available zinc gluconate (5ml = 20mg) was given as per the WHO dosage regimen. Zinc 10 mg –single dose for children 6 months and < 6months of age. Zinc 20 mg –single dose for children > 6 months to 5 yrs of age. In this study zinc syrup (5ml=20mg) was used based on child’s age. Pre-test was done on day one. Intervention was given on day one, day two and day three. Post-test was done on day two, day three and day four.

Aim: The aim of the study was focused towards the improvement in hydration and reduction in stool frequency in both experimental group and control group.

PILOT STUDY

In order to find out the feasibility of the study, pilot study was conducted in similar manner of the original study among 6 patients, three in the experimental group and three in control group. The pilot study was done in samples in Government Rajaji hospital at Madurai. The study found to be feasible. The pilot study participants were excluded from the main study.

DATA COLLECTION PROCEDURE

Permission was sought from the Dean, Madurai medical college and the head of the department of pediatrics. An informed oral consent was taken from the study subject's parents. The data collection period was six weeks. The samples were selected according to the criteria laid down. The research samples were selected every day. Every week on average 9-12 patients were selected for each group. The subjects were divided into experimental group and control group. The subject's parents were explained about the purpose of the study and were assured of confidentiality of the data collected.

Work sheet

Weeks	Experimental group	Control group
Week 1	5	6
Week 2	4	5
Week 3	6	6
Week 4	5	4
Week 5	4	6
Week 6	6	5

The consecutive sampling technique was adapted for this study. Consecutive patients who were admitted in the hospital between 8am to 5 pm during the data collection period and who had fulfilled the inclusion and exclusion criteria were selected

as sample. Samples in experimental and control group have been allotted based on the treatment prescription.

On day one demographic data of the samples were collected for both groups. Dehydration and diarrhoeal status was assessed by observational check lists and pre-test score was marked. Following which, WHO-ORS with zinc was administered to children in experimental group as per the WHO regimen. The WHO-ORS was diluted in on one liter of boiled and cooled water. The amount of ORS was calculated as per the table given by the WHO. Zinc 10 mg –single dose for children 6 months and < 6months of age. Zinc 20 mg –single dose for children > 6 months to 5 yrs of age. In this study zinc syrup (5ml=20mg) was used based on child's age. WHO-ORS was administered to children in the control group as per the WHO regimen.

On day two and three the WHO-ORS with zinc was administered in the same method in experimental group. The post-test dehydration and diarrhoeal status was assessed on day two, day three and day four on both experimental and control group.

DATA ANALYSIS

After the data collection, the collected data was organized, tabulated, summarized and analyzed.

Data was analyzed using both descriptive and inferential statistics.

- Percentage distribution was analyzed by frequency table to identify the severity of dehydration and diarrhoea.
- To compare the groups and to determine the effectiveness of WHO-ORS with zinc paired "t" test was computed.

- To identify the association between the dehydration and diarrhoeal status and demographic variables, chi-square test was computed.

PROTECETION OF HUMAN RIGHTS

Research proposal was approved by dissertation committee of Sacred Heart Nursing College, Madurai. Permission was obtained from Dean Government Rajaji hospital prior to the study. Oral consent of each study subject was obtained from their parents before starting data collection.

Assurance was given to the subject's parents, that confidentiality was maintained. The parents of the subjects were explained that they have rights to withdraw from the study. There was absence of physical and psychological strain to study subjects and their parents.

CHAPTER - IV

DATA ANALYSIS AND INTERPRETATION

This chapter deals with the description of the sample, classification, analysis and interpretation of the data, to conclude the achievement of the objectives of the study, The data collected is tabulated and described as follows.

Presentation of the findings of the study

Section I

1. Demographic profile of the samples.

Section II

1. Frequency and percentage distribution of children according to the pre-test and post-test level of dehydration status in experimental group.
2. Frequency and percentage distribution of children according to the pre-test and post-test level of diarrhoeal status in experimental group.
3. Frequency and percentage distribution of children according to the pre-test and post-test level of dehydration status in control group.
4. Frequency and percentage distribution of children according to the pre-test and post-test level of diarrhoeal status in control group.

Section III: Comparison of dehydration and diarrhoeal status score of the subjects.

1. Comparison of mean dehydration score among the experimental group of children before and after administration of WHO-ORS with zinc.
2. Comparison of mean dehydration score among the control group of children before and after administration of WHO-ORS

3. Comparison of mean diarrhoeal status score among the experimental group of children before and after administration of WHO-ORS with zinc.
4. Comparison of mean dehydration score among the control group of children before and after administration of WHO-ORS.
5. Comparison of mean post-test dehydration score between the children in experimental and control group.
6. Comparison of mean post-test diarrhoeal status score between the children in experimental and control group.
7. Comparison of mean post-test stool frequency score between the children in experimental and control group.
8. Comparison of mean post-test stool consistency score between the children in experimental and control group.

Section IV

1. Association between diarrhoeal status scores of experimental group and control group with selected demographic variables.

SECTION – I

Demographic profile of the samples

Table 1:

Frequency and percentage distribution of children according to the demographic variables.

Characteristics	Experimental Group N = 30		Control Group N = 30		Total N = 60	
	F	%	F	%	F	%
Age:						
➢ 3 months to 12 months	8	26.6	11	36.6	19	63.2
1. Breast feeding	1	12.5	1	8.3	2	20.8
2. Bottle feeding	1	12.5	3	24.9	4	37.4
3. Both	6	75	8	66.7	14	141.7
➢ 13 months to 3 years	15	50	16	53.3	31	103.3
➢ 3 years to 5 years	7	23.3	3	10.0	10	33.3
Sex:						
➢ Male	11	36.6	17	56.6	28	93.2
➢ Female	19	63.3	13	43.3	32	106.6
Educational status of the mother:						
➢ Illiterate	4	13.3	1	3	5	16.3
➢ Primary level education	3	10	4	13.3	7	23.3
➢ Middle school level education	9	30	4	13.3	13	43.3
➢ High school level education	4	13.3	4	13.3	8	26.6
➢ Higher secondary	9	30	11	36.6	20	66.6
➢ Graduate	1	3	5	16.6	6	19.6
➢ Post graduate	0	0	1	3	1	3

Characteristics	Experimental Group N = 30		Control Group N = 30		Total N = 60	
	F	%	F	%	F	%
Educational status of the father:						
➢ Illiterate	2	6.7	0	0	2	6.7
➢ Primary level education	4	13.3	4	13.3	8	26.6
➢ Middle school level education	8	26.6	9	30	17	56.6
➢ High school level education	11	36.6	4	13.3	15	49.9
➢ Higher secondary	4	13.3	12	40	16	53.3
➢ Graduate	1	3	0	0	1	3.0
➢ Post graduate	0	0	1	3	1	3.0
Drinking water – source:						
➢ Purified water by reverse osmosis	2	6.7	4	13.3	6	20
➢ Boiled cooled water	12	40	10	33.3	22	73.3
➢ Water supplied by the Government (without boiling)	16	53.3	16	53.3	32	106.6
Toilet Facility:						
➢ Sanitary toilet with septic tank	5	16.7	6	20	11	36.7
➢ Single toilet shared by many families	12	40	12	40	24	80
➢ Open air defecation	13	43.3	12	40	25	83.3
Sanitation:						
➢ Proper disposal of garbage	15	50	15	50	30	100
➢ Improper disposal of garbage	15	50	15	50	30	100

Characteristics	Experimental Group N = 30		Control Group N = 30		Total N = 60	
	F	%	F	%	F	%
Habit of hand washing before eating:						
➢ With plain water	11	36.6	10	33.3	21	69.9
➢ With soapy water	2	6.7	4	13.3	6	20
➢ No habit of hand washing	17	56.7	16	53.3	33	110
Habit of hand washing after toileting:						
➢ With plain water	21	70	15	50	36	120
➢ With soapy water	3	10	3	10	6	20
➢ No hand washing habit	6	20	12	40	18	60
Weight of the child:						
➢ Appropriate for age	3	10	1	3	4	13
➢ Over weight for age	0	0	0	0	0	0
➢ Malnourished	27	90	29	96.7	56	186.7
Duration of diarrhea:						
➢ < 2 days	6	20	8	26.6	14	46.6
➢ 2 – 5 days	24	80	22	73.3	46	153.3
➢ > 5 days	0	0	0	0	0	0
Vomiting:						
➢ None	27	90	25	83.3	52	173.3
➢ Some	3	10	5	16.6	8	26.6
➢ Very frequent	0	0	0	0	0	0

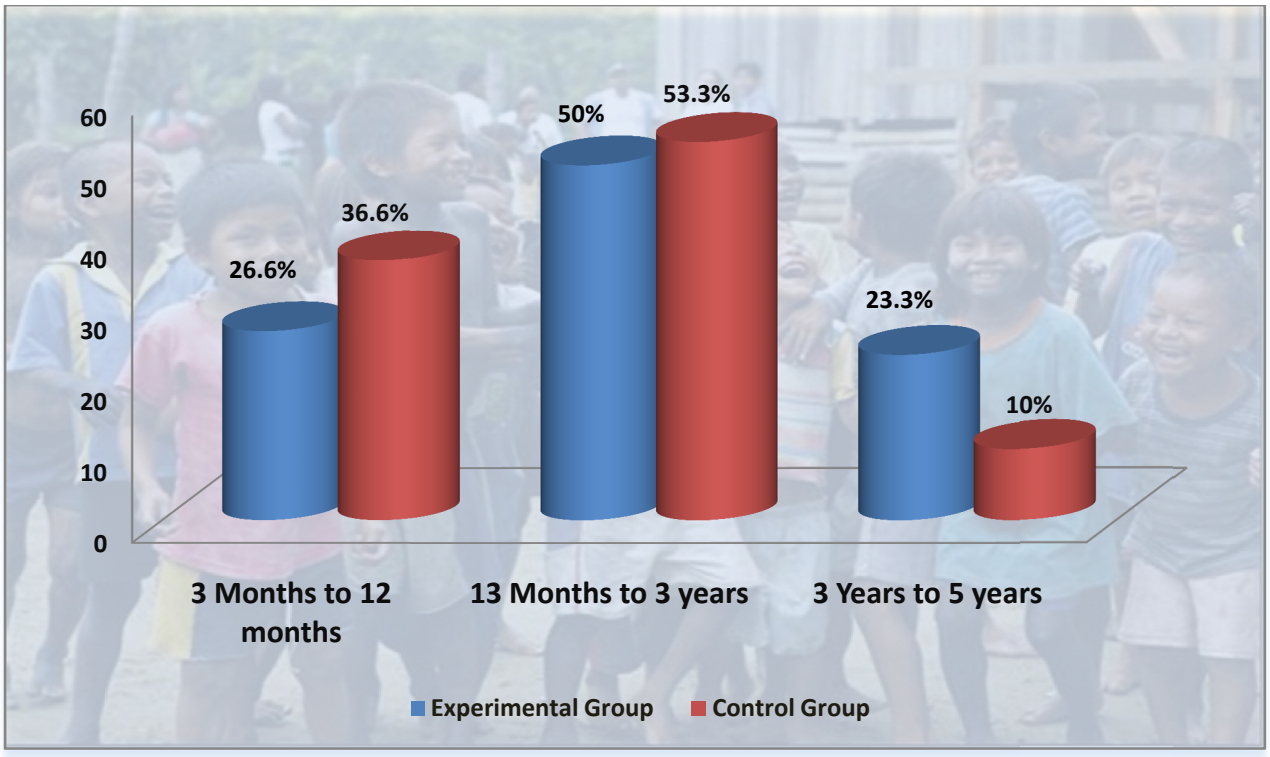

Figure-5 Distribution of samples according to age.

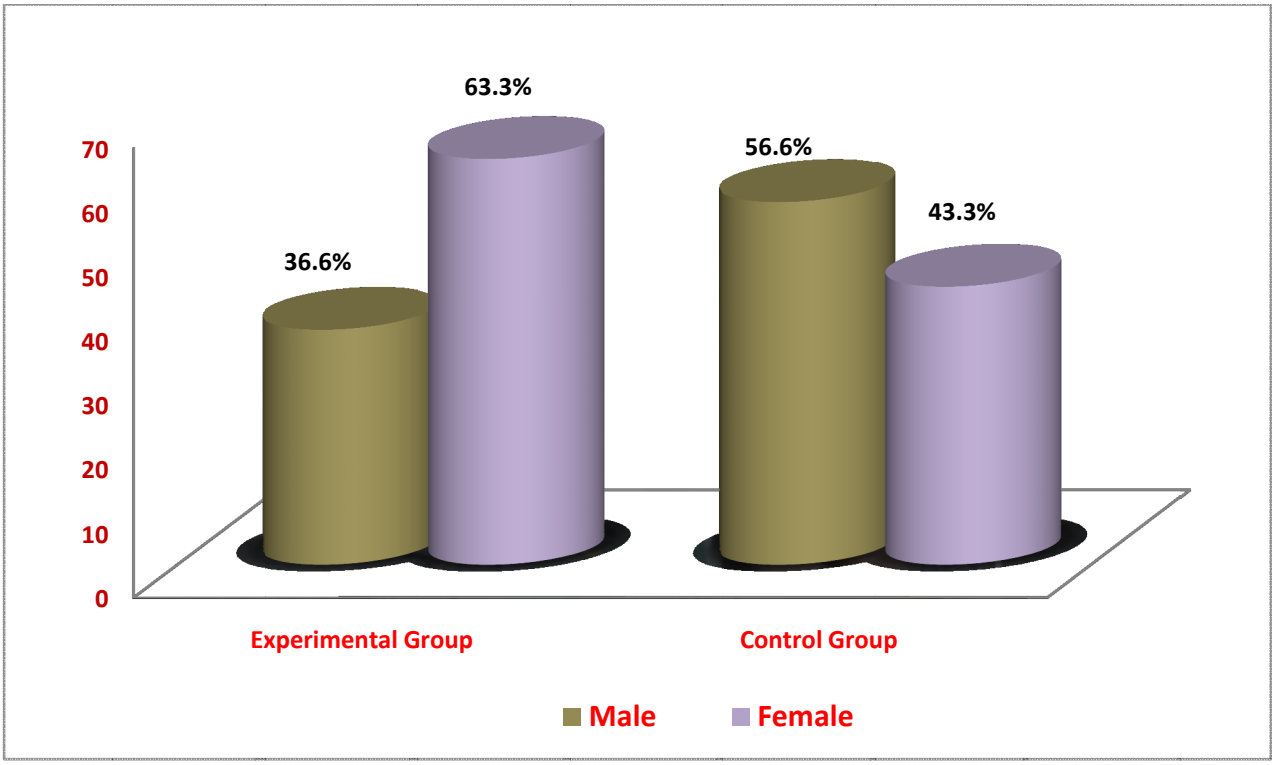

Figure-6 Distribution of samples according to sex.

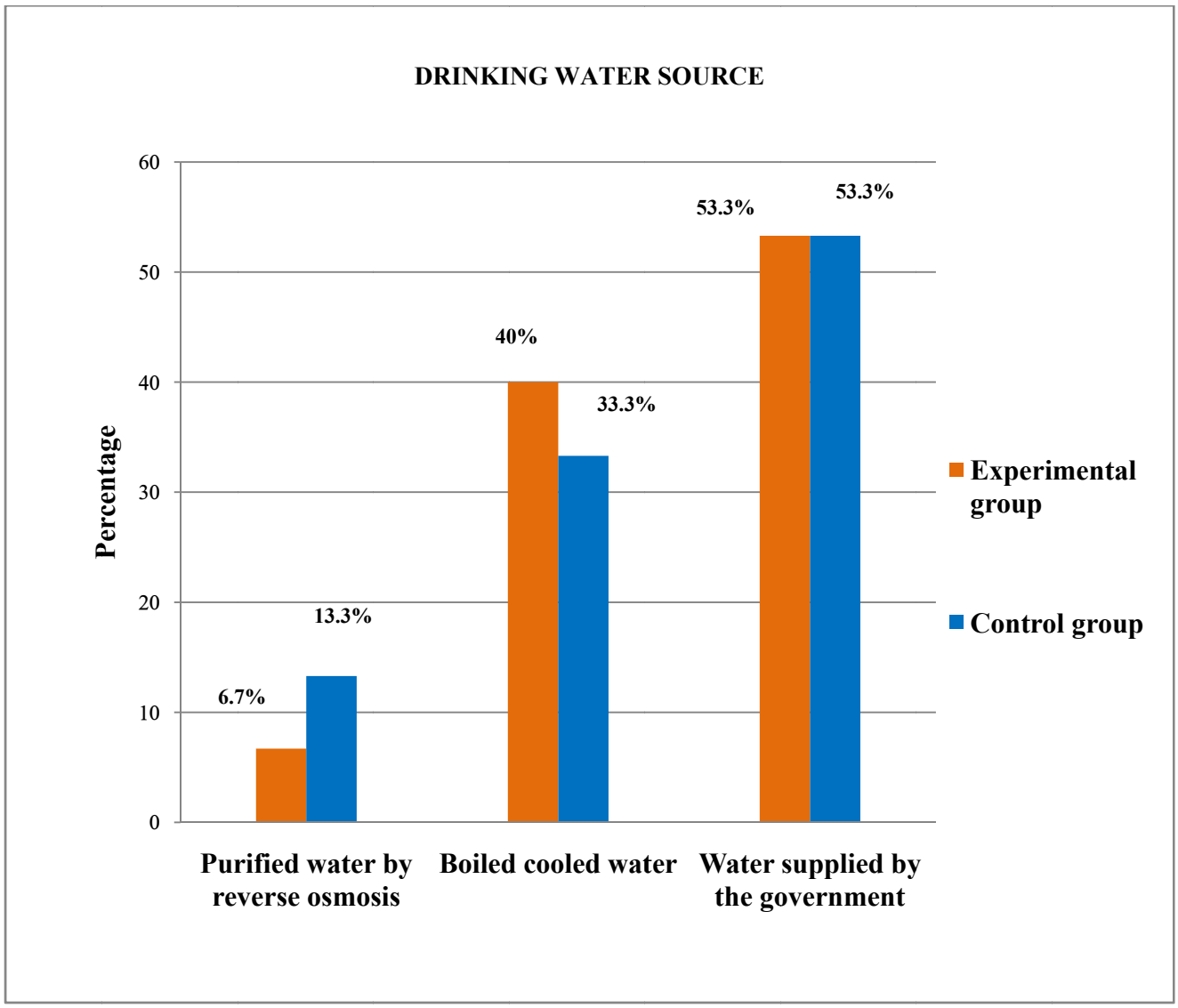

Figure-7 Distribution of samples according to Drinking water - source

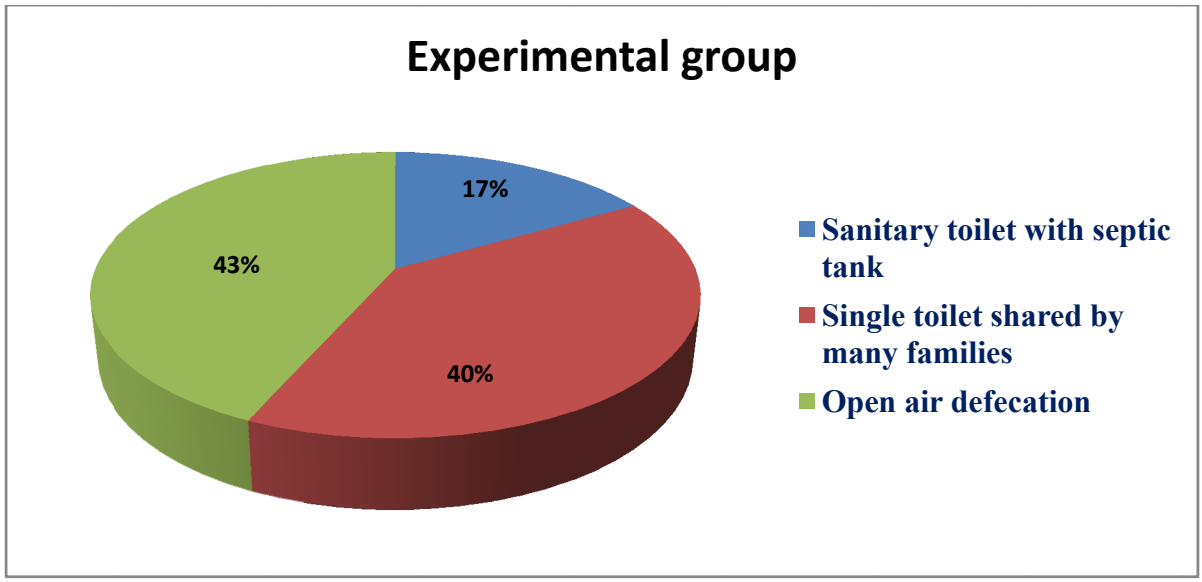

Figure-8 Distribution of samples according to the toilet facility in experimental group.

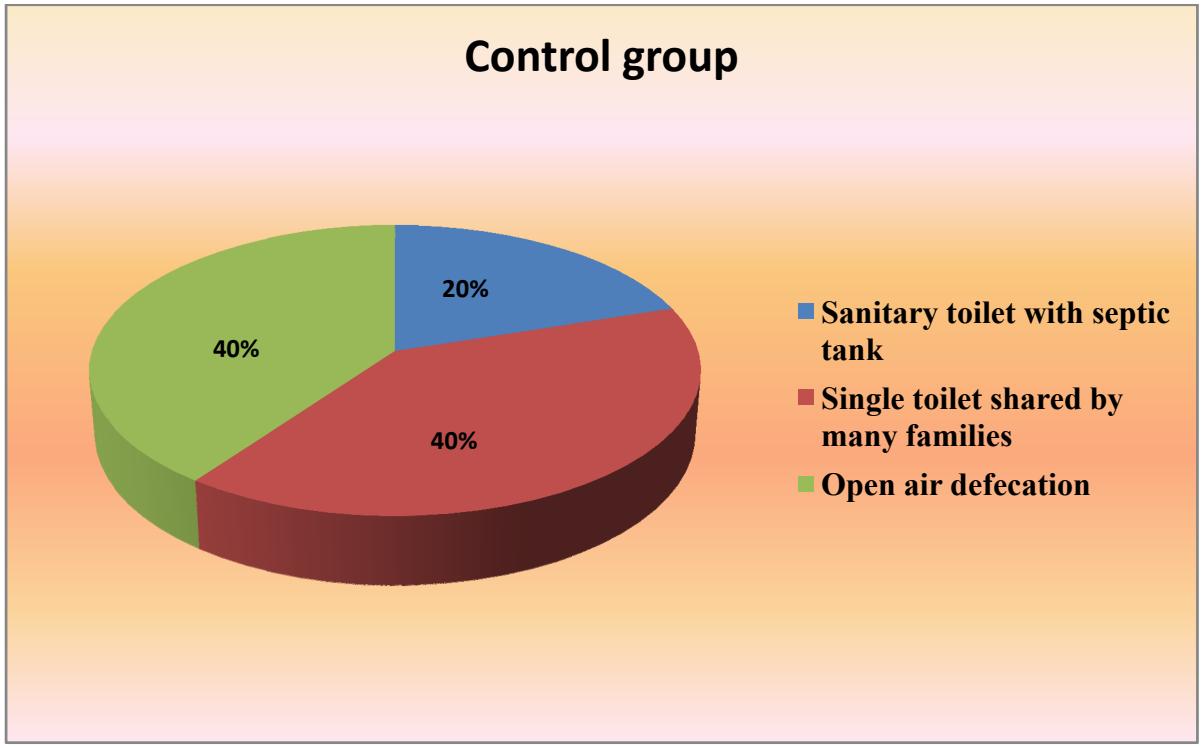

Figure-9 Distribution of samples according to the toilet facility in control group.

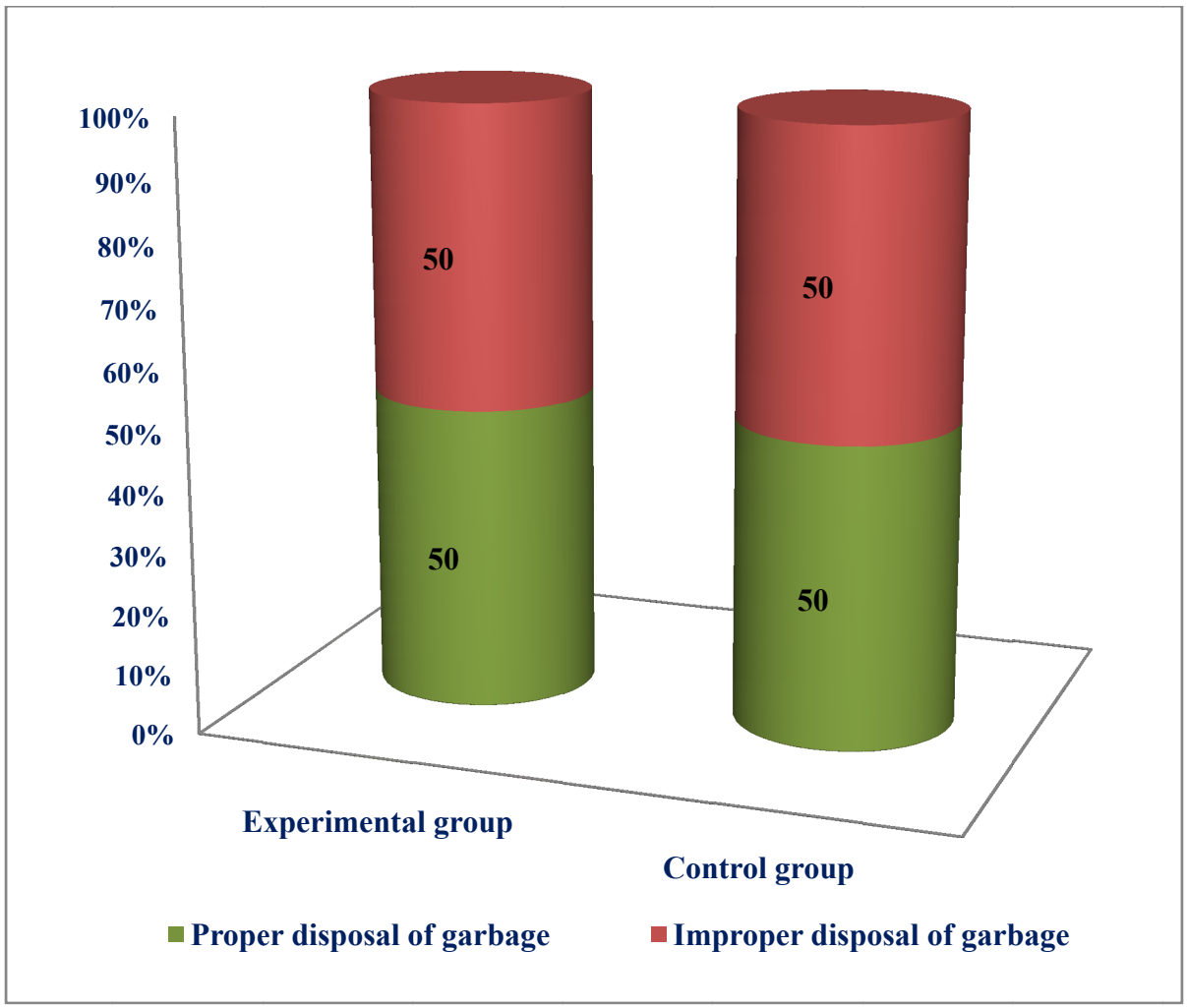

Figure -10 Distribution of samples according to Sanitation

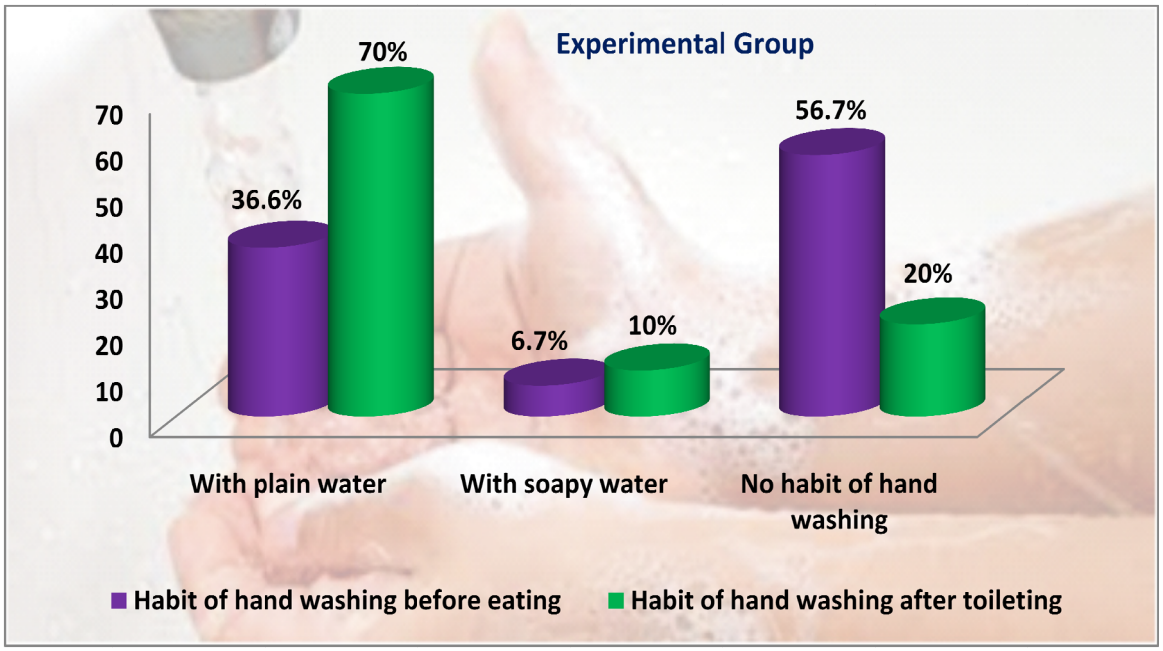

Figure-11 Distribution of samples according to Habit of hand washing before eating and after toileting in experimental group.

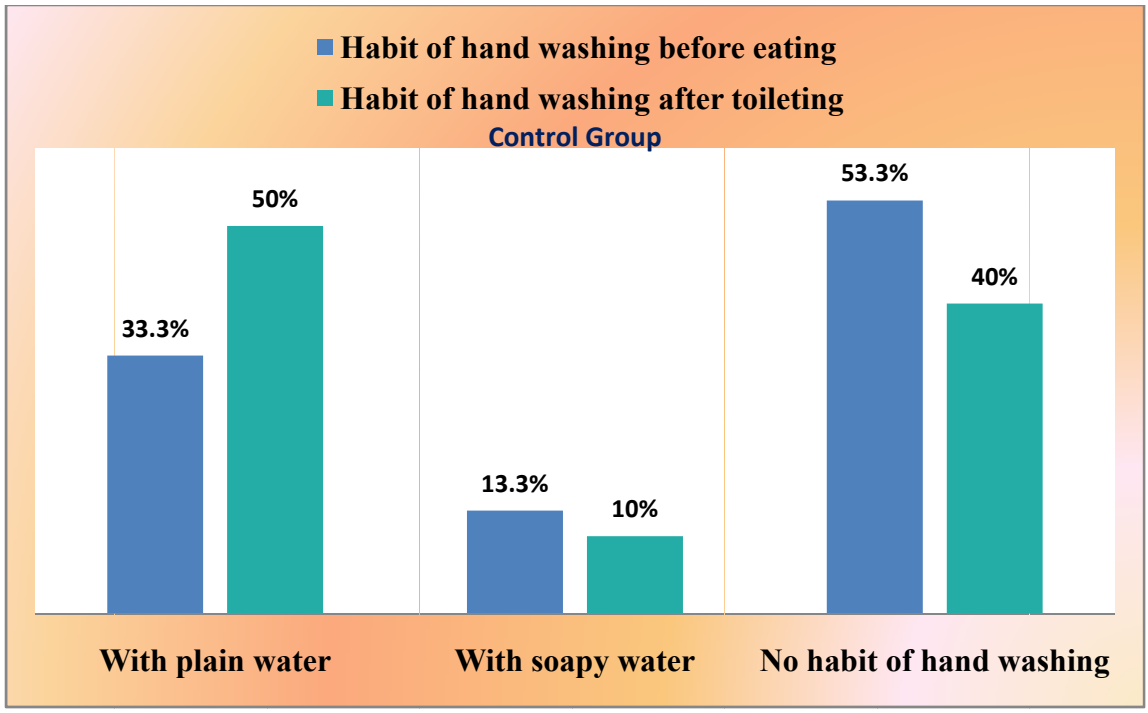

Figure-12 Distribution of samples according to Habit of hand washing before eating and after toileting in control group.

The data in the table 1 shows that,

The age of the samples varied from a minimum 3 months to maximum 5 years. Majority of the samples in the experimental group, 15 (50%) were between 13 months to 3 years and in the control group, 16 (53.30%) belongs to the age group of 13 months to 3 yrs.

Regarding sex in experimental group the majority of the samples were female 19 (63.3%) and in control group the majority of the samples were male 17 (56.6%).

With regard to mother's educational status in experimental group , 4(13.3%) had illiterate, 3(10%) had primary level education,9(30%) had middle school level education,9(30%) had higher secondary level education,1(3%) had graduates, where as in control group,1(3%) was illiterate,4(13.3%)had primary level education,4(13.3%)had middle school level education,11(36.6%)had higher secondary level education ,5(16.6%) were graduated.

With regard to father's educational status in experimental group, 2(6.7%) were illiterate, 4(13.3%) were primary level education,8(26.6%)had middle school level education,4(13.3%) had higher secondary level education,1(3%) were graduated, where as in control group,4(13.3%)had primary level education,9(30%)were middle school level education,12(40%)were higher secondary level education.

Regarding drinking water source majority of samples had used water supplied by the government (without boiling), 16(53.3%) in both experimental and control groups. Boiled cooled water was used by12 (40%) in experimental group and 10(33.3%) in control group.

With regard to toilet facility, open field defecation used by 13(43.3%) in experimental group, 12(40%) in control group. Single toilets shared by many families were same in both experimental and control group 12(40%) respectively.

Regarding sanitation the distribution was same in both experimental and control group, 15 (50%) had properly disposed in the garbage, 15(50%) had improperly disposed in the garbage.

With regard to habit of hand washing before eating majority of the samples had not washed their hands in both groups 17(56.6%)in experimental group and16(53.3%)in control group. And also 11(36.6%) washed their hands with plain water in experimental group and 10(33.3%) washed their hands with plain water in control group.

With regard to habit of hand washing after toileting in both groups, majority of the samples had washed their hands with plain water 21(70%) in experimental group, and 15(50%) in control group.

Regarding weight of the child the distribution was almost same in both experimental and control group, 27(90%) in experimental group and 29(96.7%) in control group.

With regard to duration of illness majority of the samples in experimental group were between 2 to 5 days 24(80%), and also in control group majority of the samples were between 2 to 5 days 22(73.3%).

Regarding vomiting majority of samples had presented with no vomiting in both experimental and control group 27(90%) and 25(83.3%) respectively.

SECTION – II

Table 2:

Frequency and percentage distribution of children according to the pre-test and post-test level of dehydration status in experimental group.

Dehydration	Experimental Group							
	Pre-Test		Post-Test 1		Post-Test 2		Post-Test 3	
	f	%	f	%	f	%	f	%
Dehydration Status:								
➢ No dehydration	-	-	30	100	30	100	30	100
➢ Some dehydration	30	100	-	-	-	-	-	-
➢ Severe dehydration	-	-	-	-	-	-	-	-

Based on the dehydration status obtained, the subjects were classified under into three groups. No dehydration (1-11), some dehydration (12-22) and severe dehydration (23-33).

Table 2 represents that the dehydration status in experimental group.

Under dehydration status in pre-test, 30 (100%) had some dehydration where as in post-test one, two and three, 30 (100%) had no dehydration.

Table 3:

Frequency and percentage distribution of children according to the pre-test and post-test level of diarrhoeal status in experimental group.

Diarrhoeal	Experimental Group							
	Pre-Test		Post-Test 1		Post-Test 2		Post-Test 3	
	f	%	f	%	f	%	f	%
Diarrhoeal Status:								
➢ Mild	-	-	-	-	12	40	25	83.3
➢ Moderate	15	50	30	100	18	60	5	16.7
➢ Severe	15	50	-	-	-	-	-	-

Based on diarrhoeal status 3 categorization was used, mild (1-8), moderate (9-16) and severe (17-24).

Table 3 represents that the diarrhoeal status in experimental group.

In pre-test on day one, under diarrhoeal status, 15(50%) had moderate diarrhoeal status and 15(50%) had severe diarrhoeal status. In the post-test one on day two , 30(100%) had moderate diarrhoeal status,in post-test two on day three ,12(40%) had mild diarrhoeal status,18(60%) had moderate diarrhoeal status and in post-test three on day four, 25(83.3%) had mild diarrhoeal status, 5(16.7%) had moderate diarrhoeal status.

Table 4:

Frequency and percentage distribution of children according to the pre-test and post-test level of dehydration status in control group.

Dehydration	Control Group							
	Pre-Test		Post-Test 1		Post-Test 2		Post-Test 3	
	f	%	f	%	f	%	f	%
Dehydration Status:								
➢ No dehydration	-	-	4	13.3	30	100	30	100
➢ Some dehydration	30	100	26	86.7	-	-	-	-
➢ Severe dehydration	-	-	-	-	-	-	-	-

Table 4 represents that the dehydration status in control group.

Under dehydration status in pre-test on day one, 30 (100%) had some dehydration where as in post-test one on day two, 4(13.3%) had No dehydration, 26(86.7) had some dehydration. In post-test two on day three and day four, 30 (100%) had No dehydration

Table 5:

Frequency and percentage distribution of children according to the pre-test and post-test level of diarrhoeal status in control group.

Diarrhoeal Status	Control Group							
	Pre-Test		Post-Test 1		Post-Test 2		Post-Test 3	
	f	%	f	%	f	%	f	%
Diarrhoeal Status:								
➢ Mild	-	-	-	-	3	10	15	50
➢ Moderate	15	50	27	90	27	90	15	50
➢ Severe	15	50	3	10	-	-	-	-

Table 5 implies that the diarrhoeal status in control group.

In pre-test on day one, under diarrhoeal status, 15(50%) had moderate diarrhoeal status and 15(50%) had severe diarrhoeal status. In the post-test one on day two , 27(90%) had moderate diarrhoeal status, 3(10%) had severe diarrhoeal status, in post-test two on day three, 27(90%) had moderate diarrhoeal status,3(10%) had mild diarrhoeal status and in post-test three on day four, 15(50%) had mild diarrhoeal status,15(50%) had moderate diarrhoeal status.

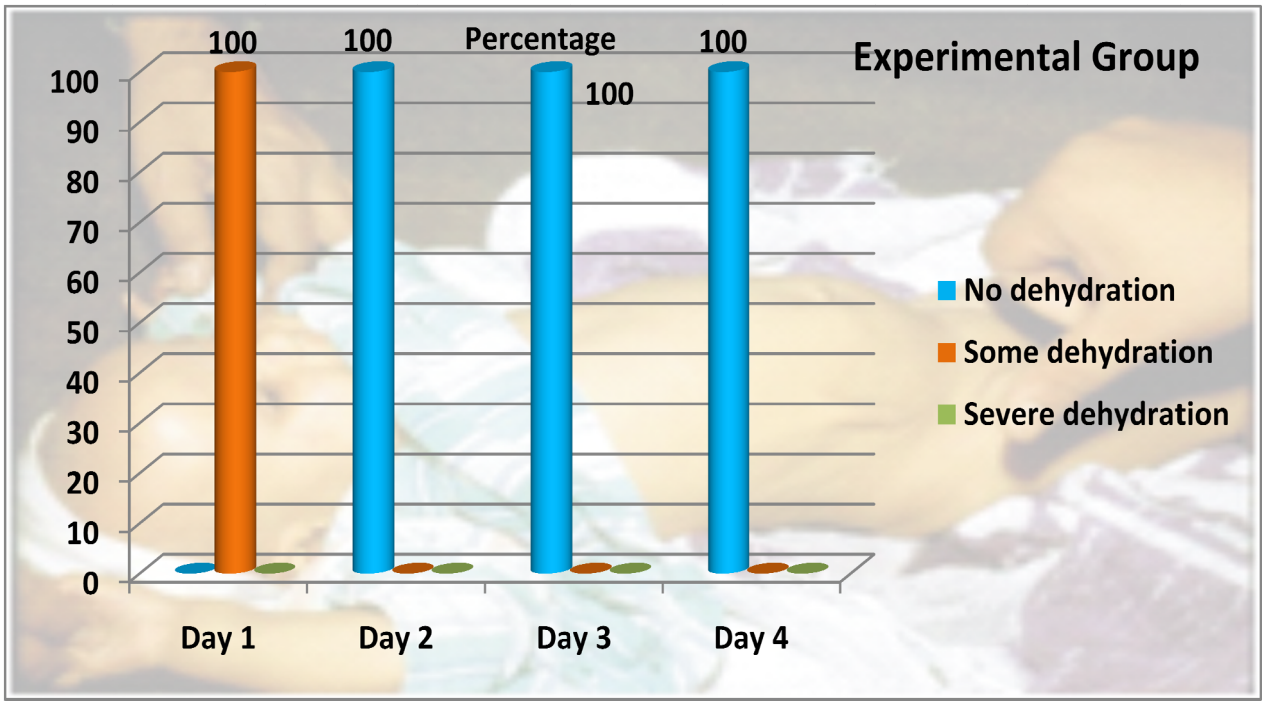

Figure 13 . Distribution of participants according to the pretest and posttest level of dehydration status in experimental group.

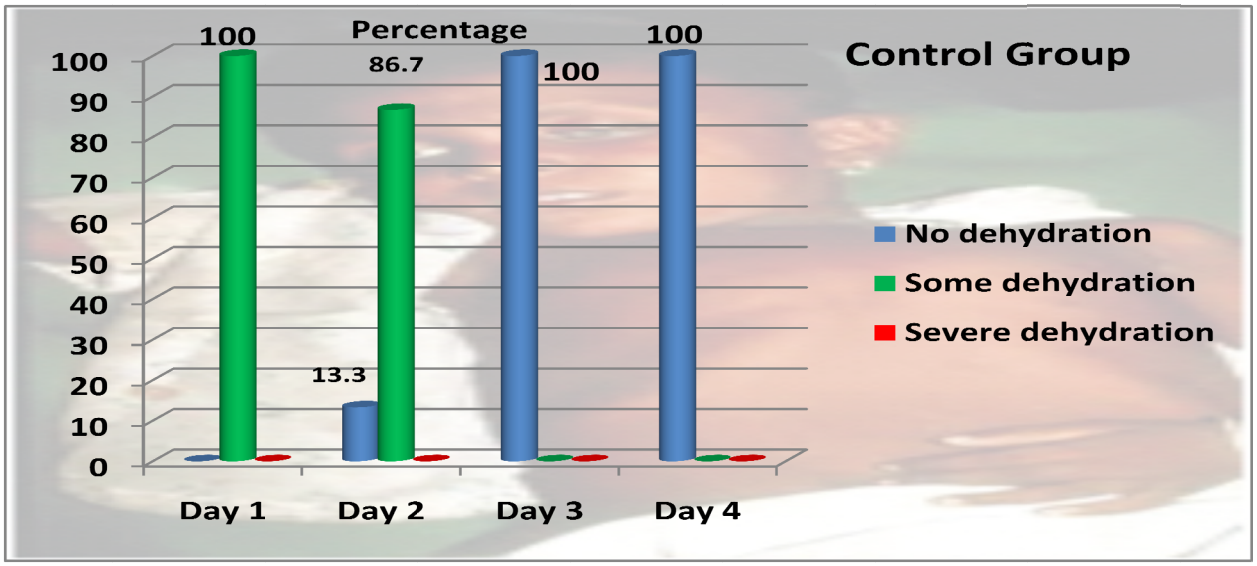

Figure 14 . Distribution of participants according to the pretest and posttest level of dehydration status in control group.

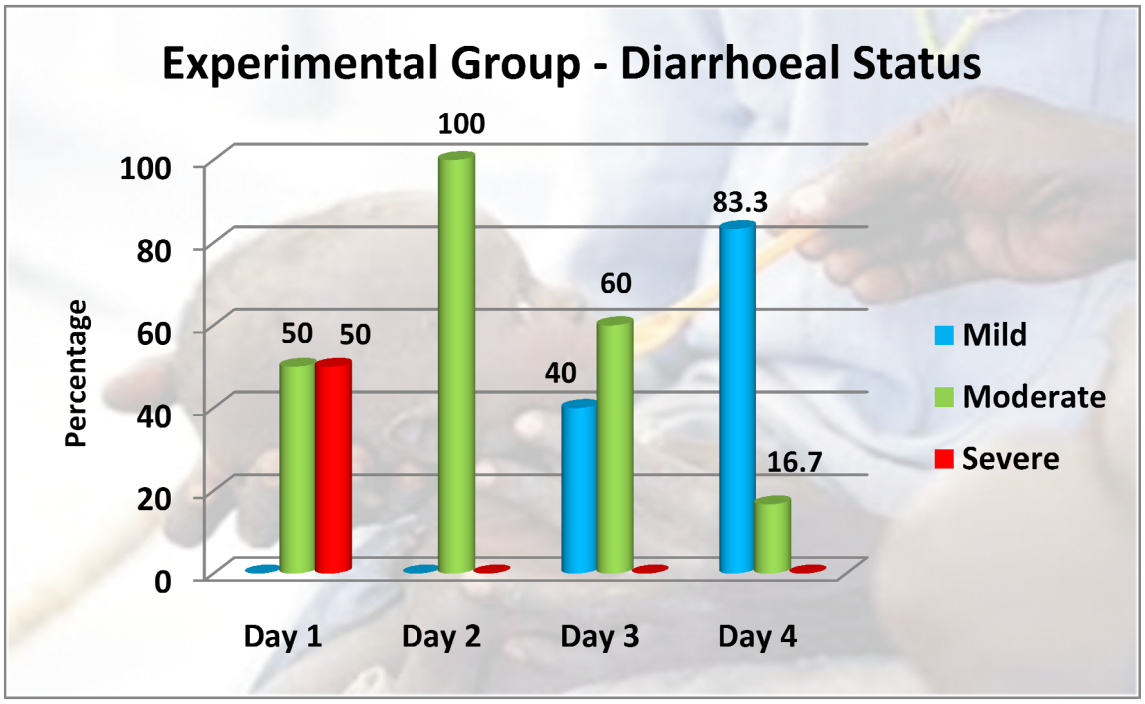

Figure 15 . Distribution of participants according to the pretest and posttest level of diarrhoeal status in experimental l group.

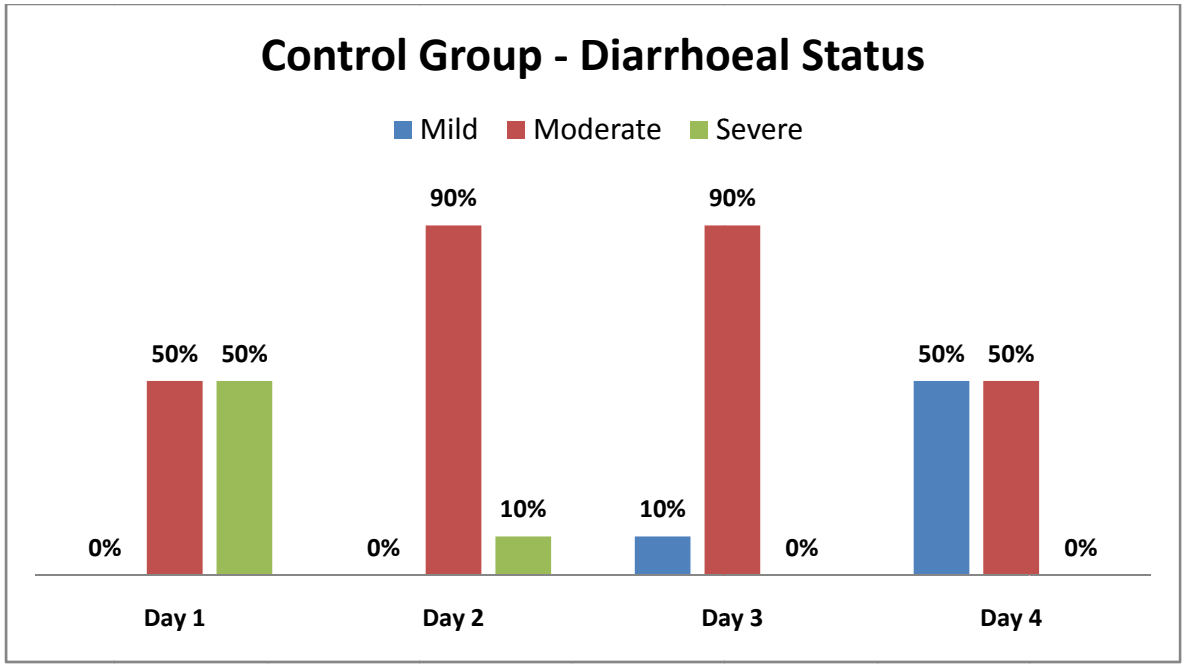

Figure 16. Distribution of participants according to the pretest and post test level of diarrhoeal status in control group.

SECTION – III

Table 6:

Comparison of mean dehydration score among the experimental group of children before and after administration of WHO-ORS with zinc.

Measurement	N	Mean	SD	't' value
Pre-test (day one)	30	18.1	1.96	-
Post-test 1 (day two)	30	11	-	19.58
Post-test 2 (day three)	30	11	-	19.58
Post-test 3 (day four)	30	11	-	19.58

* Significant at 0.05 level

To find out if there is any difference between the mean dehydration scores before and after administration of WHO-ORS with zinc, the null hypothesis was stated as follows.

H_{01}: The mean post tests dehydration status score of clients who received WHO-ORS with zinc will not be significantly lower than mean pre-test score. In the present study the observational check list on dehydration was used. A higher score indicates severe dehydration where as lower score indicates no dehydration.

Table 6 shows that mean post-tests dehydration score after administration of WHO ORS with zinc (11) was lower than the pre test mean (18.1).the obtained 't' value of 19.58 at df 29 was significant at 0.05 level. This indicates that the difference in mean is improvement of hydration status of the samples. So the researcher rejects the null hypothesis and the above findings support the research hypothesis.

Table 7:

Comparison of mean pretest and post-test dehydration score among the control group of children before and after administration of WHO-ORS.

Measurement	N	Mean	SD	't' value
Pre-test (day one)	30	18.5	1.76	-
Post-test 1 (day two)	30	13.6	1.48	9.49
Post-test 2 (day three)	30	11	-	22.5
Post-test 3 (day four)	30	11	-	22.5

***** Significant at 0.05 level

To find out if there is any difference between pre and post mean dehydration scores in control group the null hypothesis was stated as follows.

H_{02}: The mean post test dehydration status score of clients who received WHO-ORS will not be significantly lower than mean pre test score.

Table 5 shows that mean post-test one dehydration score after administration of WHO-ORS (13.6) on post test one was lower than the pre-test mean (18.5).The obtained 't' value of 9.49 at df 29 was significant at 0.05 level. The mean post-test two and three dehydration score after administration of WHO-ORS (11)was lower than the pre-test mean (18.5).The obtained 't' value of 22.5 at df29 was significant at 0.05 level. This findings support the research hypothesis. So the researcher rejects the null hypothesis.

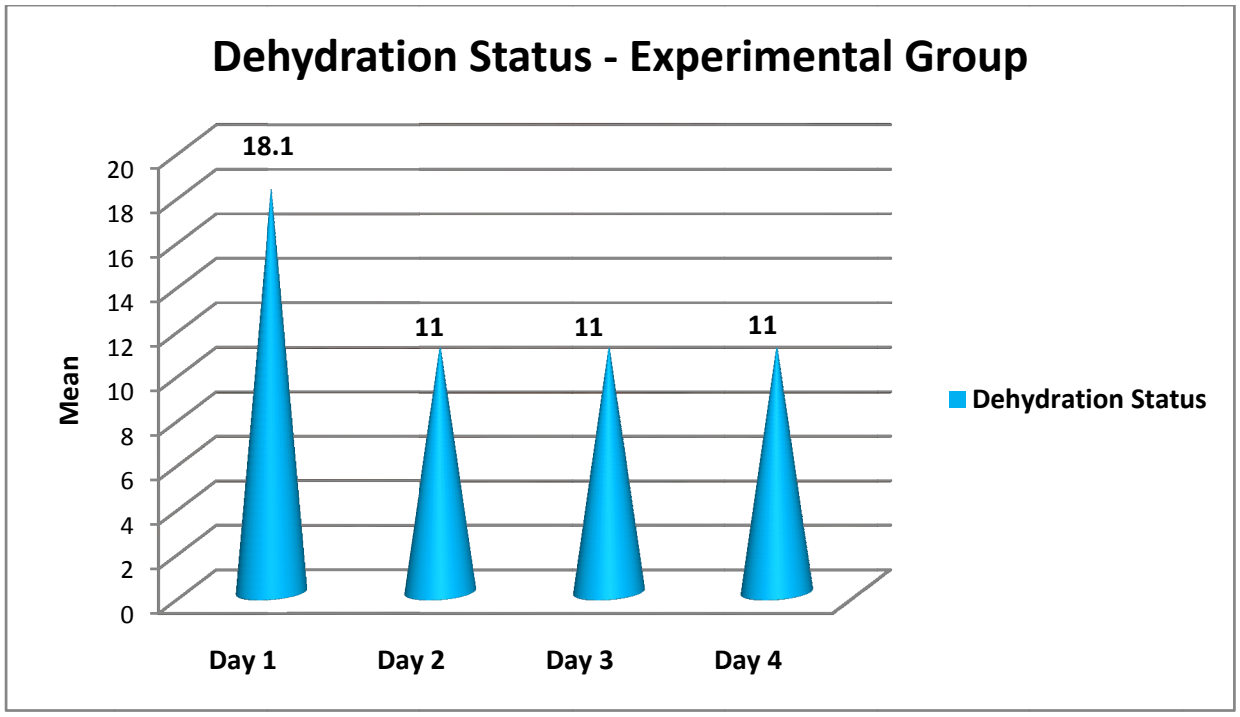

Figure. 17 Comparison of mean dehydration score among the experimental group of children before and after administration of WHO-ORS with zinc.

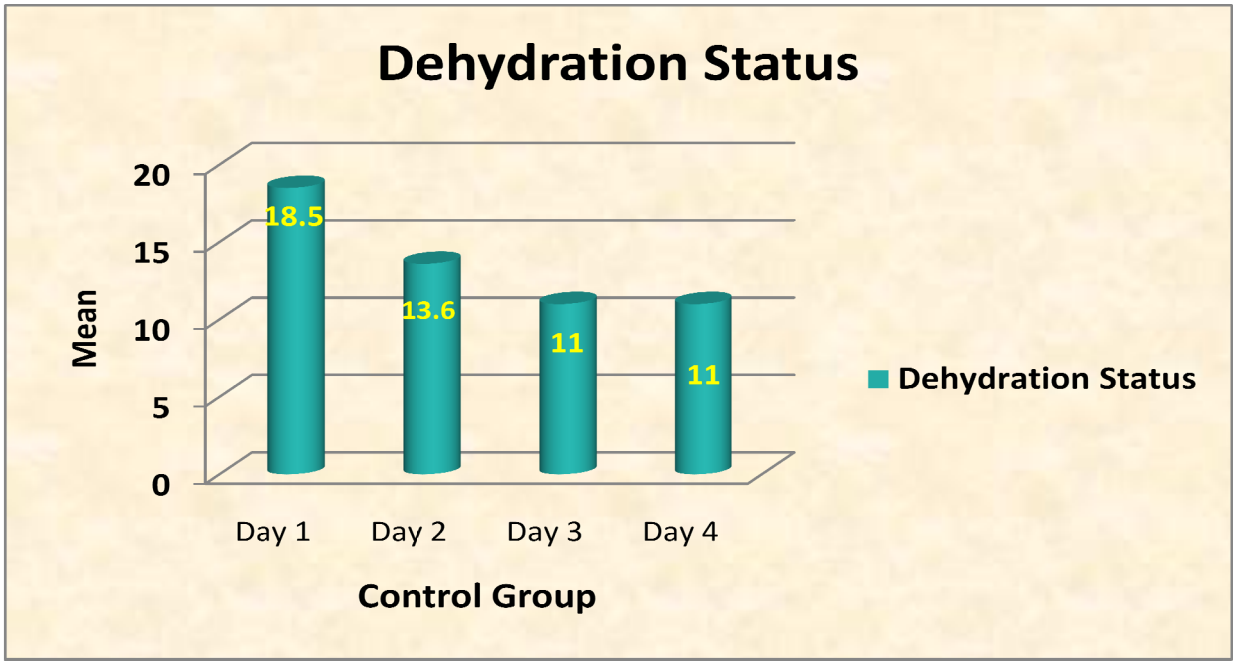

Figure 18.Comparison of mean dehydration score among the control group of children before and after administration of WHO-ORS.

Table 8:

Comparison of mean diarrhoeal status score among the experimental group of children before and after administration of WHO-ORS with zinc.

Measurement	N	Mean	SD	't' value
Pre-test (day one)	30	16.2	2	-
Post-test 1 (day two)	30	12.9	1.63	13
Post-test 2 (day three)	30	9.3	1.33	20
Post-test 3 (day four)	30	8.3	0.63	22.99

* Significant at 0.05 level

To find out if there is any difference between the mean diarrhoeal status scores before and after administration of WHO-ORS with zinc, the null hypothesis was stated as follows.

H_{03}: The mean post-test dehydration status score of clients who received WHO-ORS will not be significantly lower than mean pre-test score.

The mean post-tests diarrhoeal status score of clients who received WHO-ORS with zinc will not be significantly lower than mean pre-test score. A higher score indicates severe diarrhoea where as lower score indicates mild diarrhoea.

Table 8 shows that mean post-tests diarrhoeal status score after administration of WHO-ORS with zinc (12.9), (9.3), (8.3) was lower than the pre-test mean (16.2).The obtained 't' values of 13, 20 and 22.99 at df 29 was significant at 0.05 level. This indicates that the difference in mean is improvement in the diarrhoeal status of the samples. So the researcher rejects the null hypothesis and the above findings support the research hypothesis.

Table 9:

Comparison of mean pre-test and post-test diarrhoeal status score among the children in the control group before and after administration of WHO-ORS.

Measurement	N	Mean	SD	't' value
Pre-test (day one)	30	16.5	2	-
Post-test 1 (day two)	30	14.8	1.45	7.04
Post-test 2 (day three)	30	12.1	1.55	14.68
Post-test 3 (day four)	30	9.5	1.15	26.22

* Significant at 0.05 level

To find out if there is any difference between the mean diarrhoeal status scores before and after administration of WHO-ORS, the null hypothesis was stated as follows.

H_{04}: The mean post-tests diarrhoeal status score of clients who received WHO-ORS will not be significantly lower than mean pre-test score. A higher score indicates severe diarrhoea where as lower score indicates mild diarrhoea.

Table 9 shows that mean post-tests diarrhoeal status score after administration of WHO-ORS (14.8), (12.1), (9.5) was lower than the pre-test mean (16.5).The obtained 't' values of 7.04, 14.68 and 26.22 at df 29 was significant at 0.05 level. This findings support the research hypothesis. So the researcher rejects the null hypothesis.

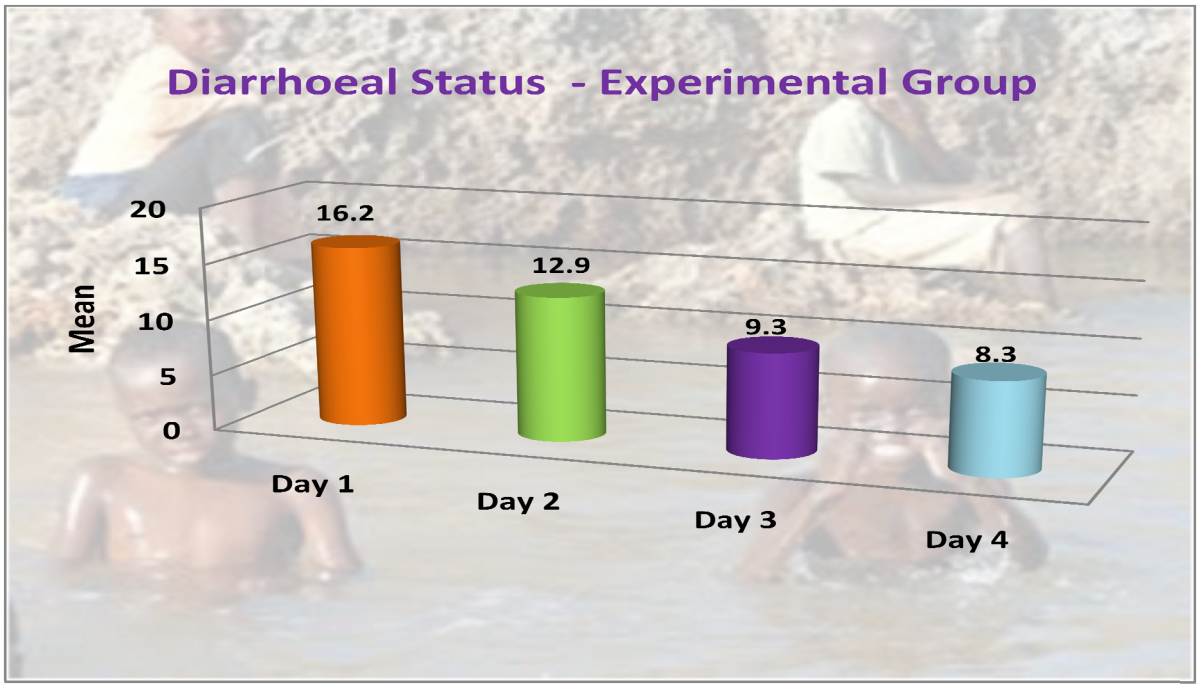

Figure 19.Comparison of mean diarrhoeal status score among the experimental group of children before and after administration of WHO-ORS with zinc.

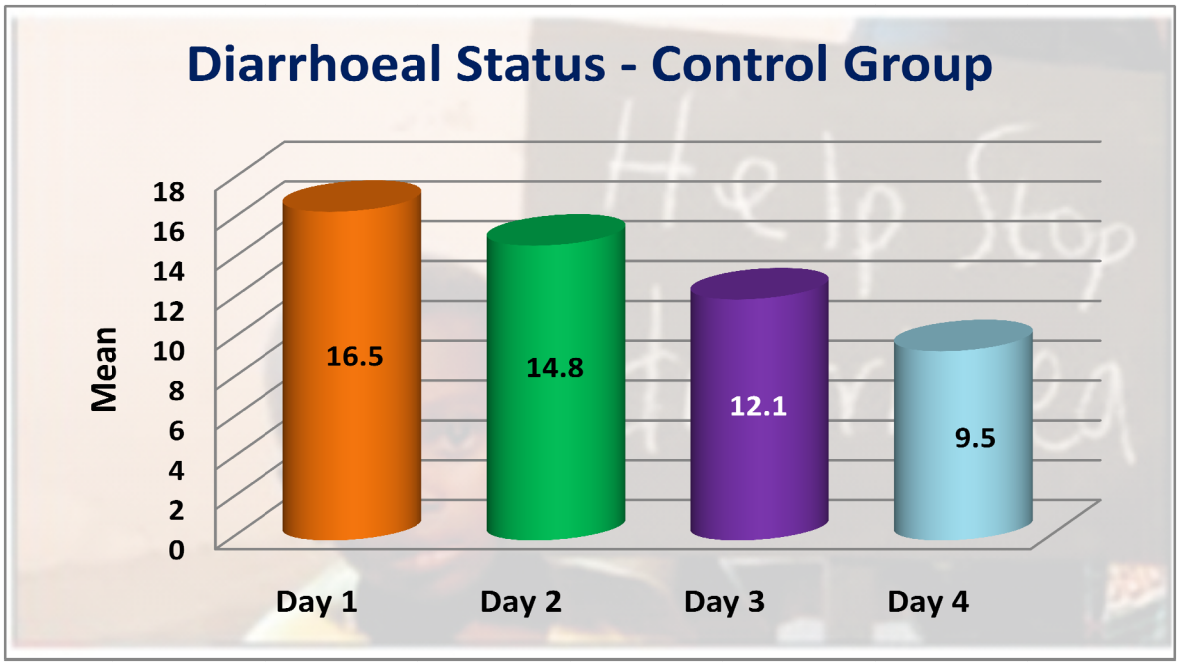

Figure.20 Comparison of mean diarrhoeal status score among the control group of children before and after administration of WHO-ORS.

Table 10

Comparison of mean post-test dehydration score between the children in the experimental and control group.

Measurement	N	Mean	SD	't' value
Day 2				
Experimental Group	30	11	0	-
Control Group	30	13.6	1.48	9.49

* Significant at 0.05 level

To find out if there is any difference between mean dehydration score of experimental and control group the null hypothesis was stated as follows.

H_{05}: The mean post-test dehydration status score of clients who received WHO-ORS will not be significantly higher than the mean post-test dehydration status score of clients who had received WHO-ORS with zinc.

Table 10 shows that mean post-test1 dehydration score after administration of WHO-ORS (13.6) was significantly higher than the mean post-test1 dehydration score after administration of WHO-ORS with zinc (11).The mean post-test 2 and 3 dehydration score after administration of WHO-ORS (11) was same as the mean post-test2 and 3 dehydration score after administration of WHO-ORS with zinc (11).The obtained't' value of 9.49 at df (58) was significant at 0.05 level. The difference between the mean (2.6) is a true difference, and has not occurred by chance. This findings support the research hypothesis. So the researcher rejects the null hypothesis.

Table 11:

Comparison of mean post-test diarrhoeal status score between the children in the experimental and control group.

Measurement	N	Mean	SD	't' value
Day 2				
Experimental Group	30	12.9	1.63	-
Control Group	30	14.8	1.45	4.67
Day 3				
Experimental Group	30	9.3	1.33	-
Control Group	30	12.1	1.55	7.43
Day 4				
Experimental Group	30	8.3	0.63	-
Control Group	30	9.5	1.15	4.94

* Significant at 0.05 level

To find out if there is any difference between mean diarrhoeal status score of experimental and control group the null hypothesis was stated as follows.

H_{06}: The mean post-test diarrhoeal status score of clients who received WHO-ORS will not be significantly higher than the mean post-test diarrhoeal status score of clients who received WHO-ORS with zinc.

Table 11 shows that mean post-tests diarrhoeal status score after administration of WHO-ORS(14.8), (12.1) and (9.5) was significantly higher than the mean post-tests diarrhoeal status score after administration of WHO-ORS with zinc(12.9), (9.3) and (8.3).The obtained 't' value of 4.67, 7.43 and 4.94at df (58) was significant at 0.05 level. The difference between the mean (1.9), (2.8) and (1.2) are true difference, and has not occurred by chance. This findings support the research hypothesis. So the researcher rejects the null hypothesis.

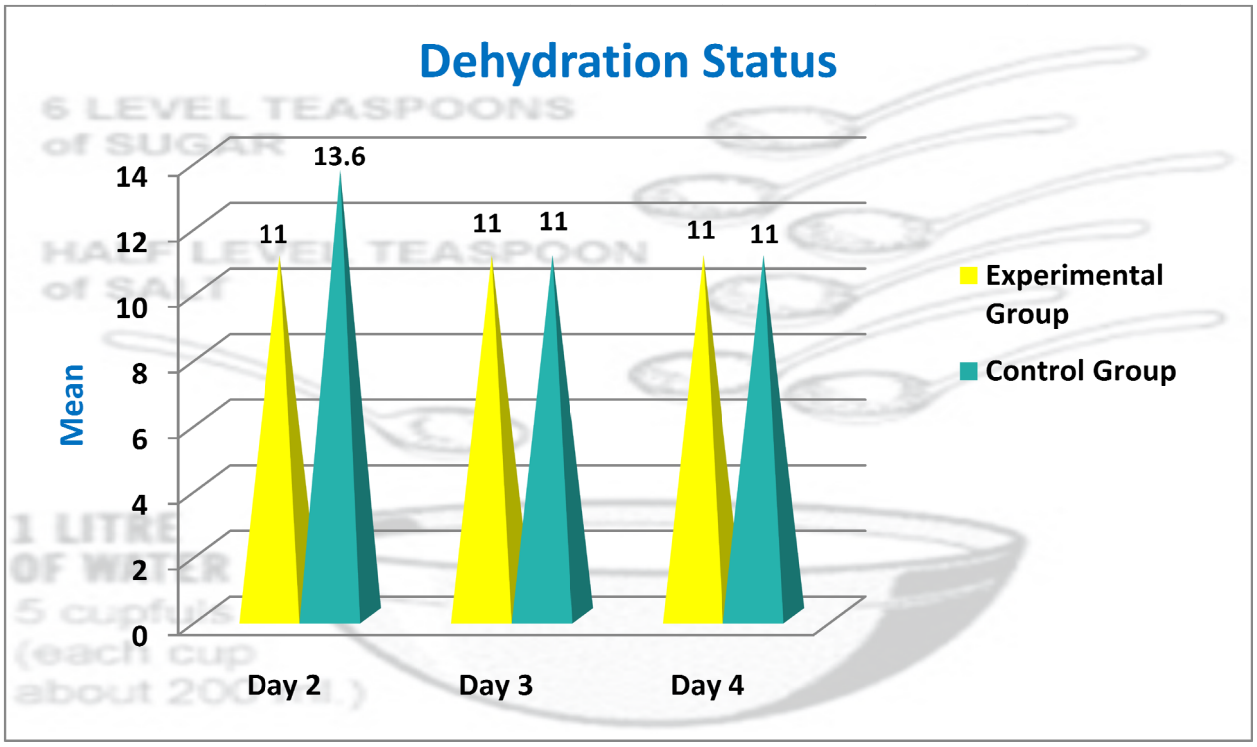

Figure.21 Comparison of mean post test dehydration score between the children in the experimental and control group.

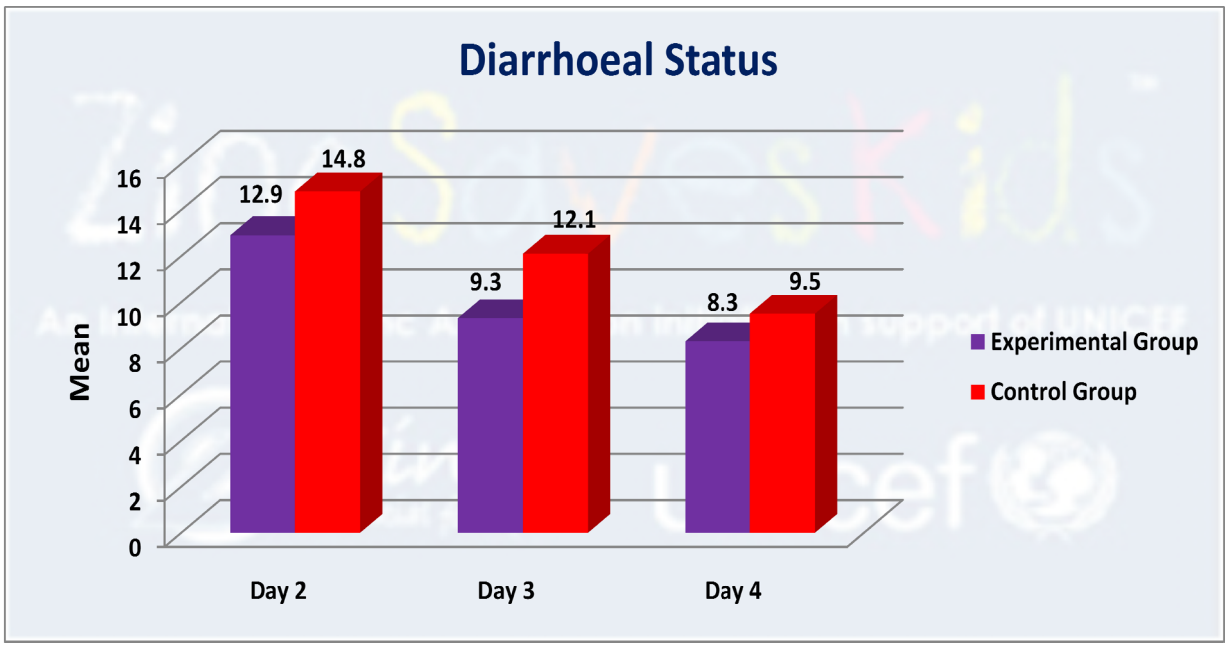

Figure.22 Comparison of mean post test diarrhoeal status score between the children in the experimental and control group

Table 12:

Comparison of mean post-test stool frequency score between the children in the experimental and control group.

Measurement	N	Mean	SD	't' value
Day 2				
Experimental Group	30	7.7	1.21	-
Control Group	30	9.1	1.04	4.87
Day 3				
Experimental Group	30	4.3	1.93	-
Control Group	30	6.8	1.30	5.96
Day 4				
Experimental Group	30	2	0.58	-
Control Group	30	3.7	1.40	5.98

* Significant at 0.05 level

To find out if there is any difference between mean stool frequency score of experimental and control group the null hypothesis was stated as follows.

H_{07}: The mean post-test stool frequency score of clients who received WHO-ORS will not be significantly higher than the mean post-test stool frequency score of clients who received WHO-ORS with zinc.

Table 12, shows that mean post-tests on day 2,3 and 4the stool frequency score after administration of WHO-ORS(9.1), (6.8) and (3.7) was significantly higher than the mean post-tests stool frequency score after administration of WHO-ORS with zinc(7.7), (4.3) and (2).The obtained' value of 4.87, 5.96and 5.98 at df (58) was significant at 0.05 level. The difference between the mean (1.4), (2.5) and (1.7) are true difference, and has not occurred by chance. So it can be inferred that WHO-ORS with zinc has a significant role in reducing the stool frequency in diarrhoea. So, the researcher rejects the null hypothesis and the above findings support the research hypothesis.

Table 13:

Comparison of mean post-test stool consistency score between the children in experimental and control group.

Measurement	N	Mean	SD	't' value
Day 2				
Experimental Group	30	1.9	0.36	-
Control Group	30	2.4	0.50	4.4
Day 3				
Experimental Group	30	1.3	0.47	-
Control Group	30	2	0.18	6.76
Day 4				
Experimental Group	30	1.1	0.30	-
Control Group	30	1.5	0.50	3.69

* Significant at 0.05 level

To find out if there is any difference between mean stool consistency score of experimental and control group the null hypothesis was stated as follows.

H_{08}: The mean post-tests stool consistency score of clients who received WHO-ORS will not be significantly higher than the mean post-test stool consistency score of clients who received WHO-ORS with zinc.

Table -13, shows that mean post-tests on day 2, 3 and 4 the stool consistency score after administration of WHO-ORS (2.4), (2) and (1.5) was significantly higher than the mean post-tests stool frequency score after administration of WHO-ORS with zinc (1.9), (1.3) and (1.1).The obtained't' value of 4.4, 6.76 and 3.69 at df (58) was significant at 0.05 level. The difference between the mean (0.5), (0.7) and (0.4) are true difference, and has not occurred by chance. This findings support the research hypothesis. So the researcher rejects the null hypothesis.

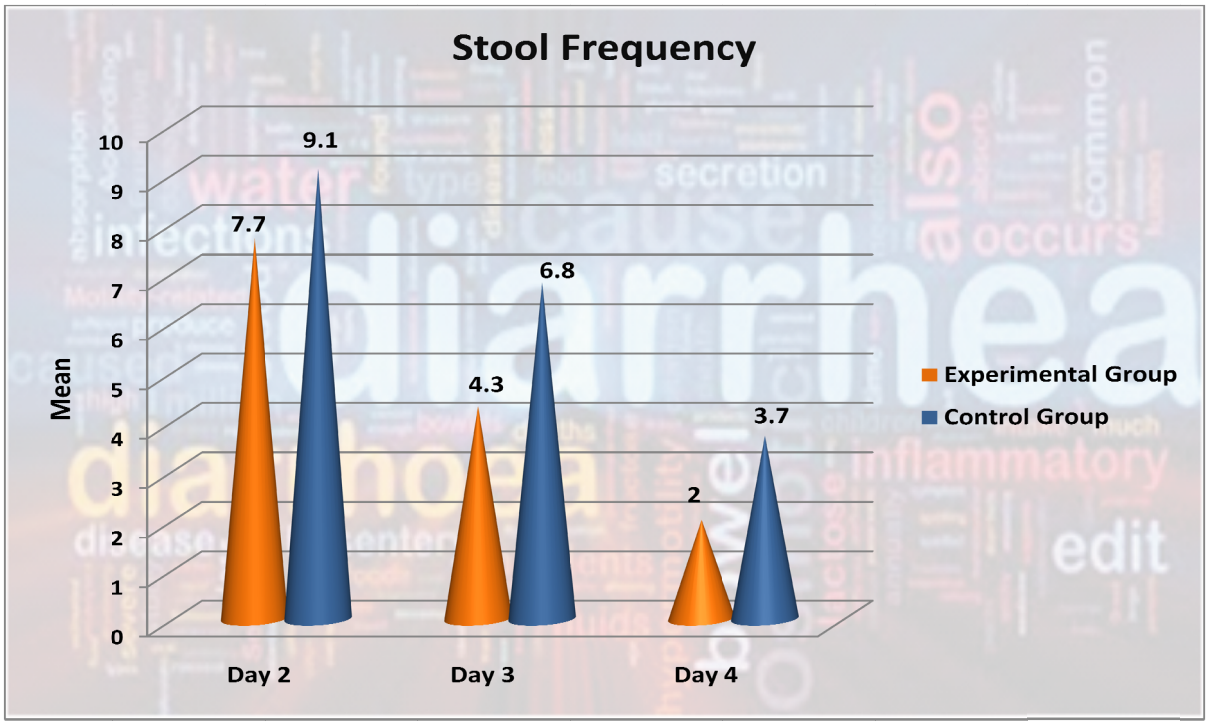

Figure .23 Comparison of mean post test stool frequency score between the children in among the experimental and control group.

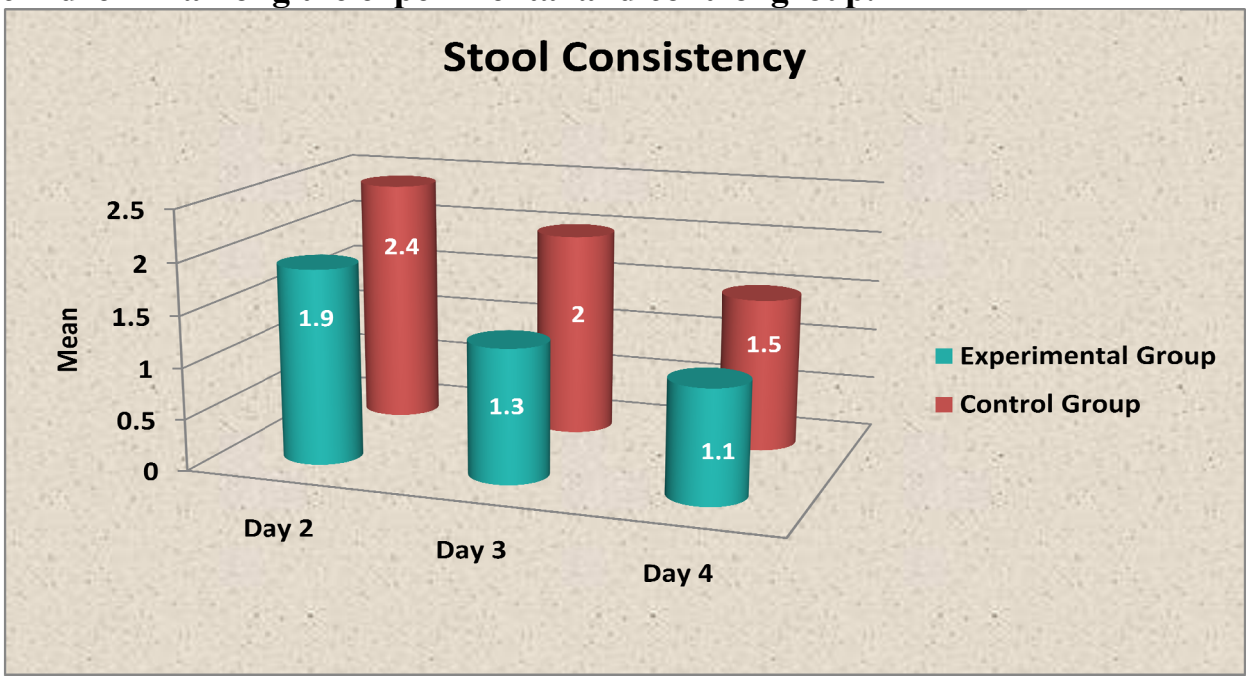

Figure. 24 Comparison of mean post test stool consistency score between the children in experimental and control group

SECTION – IV

Table 14:

This section deals with the association between mean pre-test diarrhoeal status score of experimental and control group with selected variables such as age, sex, mother's educational status, father's educational status, drinking water source, sanitation, toilet facility, habit of hand washing before eating, habit of hand washing after toileting and weight of the child.

Characteristics	N	Above mean	Below Mean	DF	$\chi 2$
Age:					
➢ 3 months to 12 months	19	7	12		
➢ 13 months to 3 years	31	19	12	2	2.83#
➢ 3 years to 5 years	10	5	5		
If age is 3 months to 12 months					
➢ Breast feeding	2	1	1		
➢ Bottle feeding	4	2	2	2	0.22#
➢ Both	13	4	9		
Sex:					
➢ Male	28	13	15	1	0.60#
➢ Female	32	18	14		
Educational status of the mother:					
➢ Illiterate	5	3	2		
➢ Primary level education	7	5	2		
➢ Middle school level education	13	7	6		
➢ High school level education	8	6	2	6	3.0#
➢ Higher secondary	20	9	11		
➢ Graduate	6	4	2		
➢ Post graduate	1	1	0		

Characteristics	N	Above mean	Below Mean	DF	$\chi 2$
Educational status of the father:					
➢ Illiterate	2	2	0		
➢ Primary level education	8	7	1		
➢ Middle school level education	17	10	7		
➢ High school level education	15	6	9	6	10.4#
➢ Higher secondary	16	6	10		
➢ Graduate	1	0	1		
➢ Post graduate	1	1	0		
Drinking water – source:					
➢ Purified water by reverse osmosis	6	3	3		
➢ Boiled cooled water	22	3	19	2	21.7*
➢ Water supplied by the Government (without boiling)	32	25	7		
Toilet Facility:					
➢ Sanitary toilet with septic tank	11	1	10		
➢ Single toilet shared by many families	24	15	9	2	9.8*
➢ Open air defecation	25	15	10		
Sanitation:					
➢ Proper disposal of garbage	30	7	23	1	19.3*
➢ Improper disposal of garbage	30	24	6		
Habit of hand washing before eating:					
➢ With plain water	21	4	17		
➢ With soapy water	6	3	3	2	15.0*
➢ No habit of hand washing	33	24	9		
Habit of hand washing after toileting:					
➢ With plain water	36	14	22		
➢ With soapy water	6	2	4	2	10.4*
➢ No hand washing habit	18	15	3		

Characteristics	N	Above mean	Below Mean	DF	$\chi 2$
Weight of the child:					
➢ Appropriate for age	4	2	2		
➢ Over weight for age	0	0	0	2	0.005#
➢ Malnourished	56	29	27		

***** Significant at 0.05 level

Not significant at 0.05 level

To find out if there is any association between diarrhoea status score of subjects and the selected variables such as age, sex, mother's educational status, father's educational status, drinking water source, sanitation, toilet facility, habit of hand washing before eating ,habit of hand washing after toileting and weight of the child ,the null hypothesis was stated as follows

H_{08}:

There will be no association between the mean diarrhoeal status score and selected demographic variables age, sex, mother's educational status, father's educational status, drinking water source, sanitation, toilet facility ,habit of hand washing before eating ,habit of hand washing after toileting and weight of the child among children with diarrhoea in experimental group and control group.

Table 14, shows that there was no association between diarrhoea status score and age, obtained chi-square value 2.83 at df (2) was not significant at 0.05 levels.

Diarrhoeal status score and method of feeding the calculated chi-square value 0.22 at df (2) was not significant at 0.05 levels.

Regarding diarrhoeal status score and sex, the calculated chi-square value 0.60 at df (1) was not significant at 0.05 levels.

Diarrhoeal status score and educational status of the mother, the calculated chi-square value 3.0 at df (6) was not significant at 0.05 levels.

Diarrhoeal status score and educational status of the father, the calculated chi-square value 10.4 at df (6) was not significant at 0.05 levels.

It was found that there is association between drinking water source, toilet facility, sanitation, habit of hand washing before eating, habit of hand washing after toileting and the diarrhoeal status score.

The obtained chi-square value 21.7 at df (2) was significant at 0.05 level for drinking water source, 9.8 at df (2) was significant at 0.05 level for toilet facility, 19.3at df (2) was significant at 0.05 level for sanitation, 15.0 at df (2) was significant at 0.05 level for habit of hand washing before eating, and 10.4at df (2) was significant at 0.05 level for habit of hand washing after toileting.

Regarding diarrhoeal status score and weight of the child, the calculated chi-square value 0.005 at df (2) was not significant at 0.05 levels.

CHAPTER - V

DISCUSSION

This study was conducted to evaluate the effectiveness of WHO-ORS with zinc on dehydration and diarrhoeal status among the children aged between 3months to 5 years with diarrh0ea admitted in Government Rajaji Hospital at Madurai. The tool used for this study was observational check list on dehydration and observational checklist on diarrhoeal status.

The study findings are discussed in this chapter with reference to the objectives, and hypothesis as stated in chapter I.

MAJOR FINDINGS OF THIS STUDY

DEMOGRAPHIC CHARECTERISTICS OF THE SAMPLES.

- With regard to age, in both experimental group and control group majority of samples are between 13 months to 3 yrs. 15 (50%) and16 (53.30%) respectively.
- Regarding sex, in experimental group the majority of the samples were female 19 (63.3%) and in control group the majority of the samples were male 17 (56.6%).
- With regard to mother's educational status in experimental group, 4(13.3%) were illiterates, where as in control group, one mother (3%) was illiterate.
- With regard to father's educational status in experimental group, 28(93.3%) were illiterates, where as in control group, 30 (100%) were illiterates.
- Regarding drinking water source majority of samples had used water supplied by the government (without boiling), 16(53.3%) in both groups.
- With regard to toilet facility open field defecation was used by 13(43.3%) in experimental group, 12(40%) in control group.

- Regarding sanitation the distribution was same in both experimental and control group, 15 (50%) had properly disposed in the garbage, 15(50%) had improperly disposed in the garbage.
- With regard to habit of hand washing before eating majority of the samples had not washed their hands in both groups 17(56.6%) in experimental group and16(53.3%)in control group.
- With regard to habit of hand washing after toileting in both groups, majority of the samples had washed their hands with plain water 21(70%) in experimental group, and 15(50%) in control group.
- Regarding weight of the child the distribution was almost same in both experimental and control group, 27(90%) in experimental group and 29(96.7%) in control group.
- With regard to duration of illness majority of the samples in experimental group were between 2 to 5 days 24(80%), and also in control group majority of the samples were between 2 to 5 days 22(73.3%).
- Regarding vomiting majority of samples had presented with no vomiting in both experimental and control group 27(90%) and 25(83.3%) respectively.
- The above data shows that the experimental and control groups were similar in forms of the demographic variables such as age, parents education, drinking water source ,sanitation, toilet facility,habit of hand washing before eating ,habit of hand washing after toileting ,weight of the child, duration of illness, and vomiting.

1. The first objective of the study was to assess the pre-test and post-test dehydration and diarrhoeal status among the children in experimental group who had WHO-ORS with zinc.

As per the table 2 and 3, the distribution of participants according to the level of dehydration in experimental group, 30 (100%) had some dehydration in pre-test. And 30(100%) had no dehydration in post-test 1, 2 and 3 respectively. Under dehydration status in pre-test, 30 (100%) were in some dehydration where as in post-test 1,2and 3, 30 (100%)hadno dehydration.

In pre-test, under diarrhoeal status, 15(50%) had moderate diarrhoeal status and 15(50%) had in severe diarrhoeal status. In the post-test 1, 30(100%) had moderate diarrhoeal status, in post-test 2, 12(40%) had mild diarrhoeal status, 18(60%) were under moderate diarrhoeal status and in post-test 3, 25(83.3%) had mild diarrhoeal status, 5(16.7%) had moderate diarrhoeal status.

The following study supports the same findings,

Bahl R et al. (2002) conducted a Double-blind, randomized, and controlled trial to determine the Efficacy of zinc-fortified oral rehydration solution in 6- to 35-month-old children with acute diarrhoea**.** Children (n = 1219) with acute diarrhoea were randomly assigned to one of 3 groups. The first group received zinc syrup (15 mg zinc to 6- to 11-month-old children and 30 mg to 12- to 35-month-old children), the second group received zinc premixed with ORS (40 mg/L), and the control children received ORS only. The total number of stools was lower in the zinc-ORS group (rate ratio, 0.83; 95% CI, 0.71-0.96), as was the proportion of children with watery stools (odds ratio, 0.61; 95% CI, 0.39-0.95), compared with the control group; there was no significant effect on

diarrhoeal duration. ORS intake and proportion of children with vomiting were not significantly different between the zinc-ORS and control groups. The zinc syrup group had lower diarrhoeal duration (relative hazards, 0.89; 95% CI, 0.80-0.99) and total stools (rate ratio, 0.73; 95% CI, 0.70-0.77) than control children. They concluded that Zinc-ORS was moderately efficacious in reducing the severity of acute diarrhoea without increasing vomiting or reducing ORS intake.

2. The second objective of the study was to assess the pre-test and post-test dehydration and diarrhoeal status among the children in control group.

According to table-4 and 5, the distribution of participants according to the level of dehydration in control group 30 (100%) had some dehydration in pre-test. In post-test 1, 4(13.3%) had no dehydration, 26(86.7%) were in some dehydration. In post-test 2 and 3, 30 (100%) had no dehydration.

In pre-test, under diarrhoeal status, 15(50%) had moderate diarrhoeal status and 15(50%) had severe diarrhoeal status. In the post-test 1, 27(90%) had moderate diarrhoeal status, 3(10%) had severe diarrhoeal status, In post-test 2, 27(90%) had moderate diarrhoeal status,3(10%) had mild diarrhoeal status and in post-test 3, 15(50%) had mild diarrhoeal status ,15(50%) had moderate diarrhoeal status.

The following study supports the same findings,

Bhandari et al, (May, 2008) conducted a comparative effects of zinc supplementation plus oral rehydration salts compared with oral rehydration salts alone as a treatment for acute diarrhoea in Haryana, India. Six clusters of 30,000 people each were randomly assigned to intervention and control sites. 1-month-old to 5-year-old children with diarrhoea has selected as samples for study. Zinc and oral rehydration salts

for use in diarrhoeal episodes in intervention communities and oral rehydration salts alone were promoted in control group. The 24-hour prevalence of diarrhoea and acute lower respiratory infections were lower in the intervention communities. Diarrhoea, and pneumonia hospitalizations in the preceding 3 months were reduced in the intervention compared with control areas. Diarrhoea is more effectively treated when caregivers receive education on zinc supplementation and have ready access to supplies of oral rehydration salts and zinc.

3. The third objective of the study was to evaluate the effectiveness of WHO-ORS with zinc on dehydration status among children with diarrhoea in experimental group.

According to table-6, comparison of pre-test and post-tests mean dehydration score in experimental group after administration of WHO-ORS with zinc (11) was lower than the pre-test mean (18.1). The obtained't' value of 19 at df 29 was significant at 0.05 level. This indicates that the difference between two mean could be due to effect of WHO-ORS with zinc.

The following study supports the same findings,

Patro, Golicki and Szajewska (2008)conducted a Meta-analysis to assess zinc supplementation for acute gastroenteritis in children in Warsaw, Poland. Eighteen Randomized clinical trials (11,180 participants, mainly from developing countries) met the inclusion criteria. Use of zinc was associated with a significant reduction in diarrhoea duration (13 RCTs, 5643 infants, 0.69 day, 95% CI -0.97 to -0.40) and the risk of diarrhoea lasting longer than 7 days [eight RCTs, n = 5769, relative risk (RR) 0.71, 95% CI 0.53-0.96].

According to table- 7, the mean post-test-1 dehydration score after administration of WHO-ORS (13.6) was lower than the pre-test mean (18.5). The mean post-test 2 and 3 dehydration score after administration of WHO-ORS (11) was lower than the pre-test mean (18.5).The obtained 't' value of 21.4 at df 29 was significant at 0.05 level on post-test 2 and 3. The findings revealed that WHO-ORS improves the hydration status among children with diarrhoea.

The following study supports the same findings,

A Multicenter, randomized, double-blind clinical trial conducted by CHOICE Study Group (2001) to evaluate the efficacy and safety of a reduced osmolarity oral rehydration salts solution in children with acute watery diarrhoea in 5 developing countries to compare the efficacy of a reduced osmolarity oral rehydration salts (ORS) with standard World Health Organization (WHO) ORS solution. A total of 675 children who ranged in age from 1 to 24 months and who had acute diarrhoea and dehydration were enrolled in the trial; 341 were randomized to receive reduced osmolarity ORS solution, and 334 were randomized to receive the WHO-ORS solution. The mean (SE) stool output (g/kg) in the first 24 hours (reduced osmolarity ORS solution vs. WHO-ORS solution = 114 [4] vs 125 [5]) and during the total study period (reduced osmolarity ORS solution vs WHO-ORS solution = 320 [18] vs. 331 [18]) were comparable. Treatment with reduced osmolarity ORS solution was associated with a 33% reduction in the need for unscheduled intravenous therapy and had no apparent effect on stool output and illness duration when compared with treatment with the standard WHO-ORS solution. Children with acute diarrhoea, therefore, may benefit from a reduced osmolarity ORS solution

4. The fourth objective was to evaluate the effectiveness of WHO-ORS with zinc on diarrhoeal status among children with diarrhoea in experimental group.

According to table 8, the mean post-tests diarrhoeal status score after administration of WHO-ORS with zinc (12.9), (9.3), (8.3) was lower than the pre-test mean (16.2). The obtained't' values of 13.8, 20.9 and 26.7 at df 29 was significant at 0.05 level. The findings revealed that WHO -ORS with zinc was effectively reduce the diarrhoea among children

According to table -9, the mean post-tests diarrhoeal status score after administration of WHO-ORS (14.8), (12.1), (9.5) was lower than the pre-test mean (16.5). The obtained't' values of 5.9, 5.9 and 28 at df 29 was significant at 0.05 level. The findings revealed that WHO -ORS reduce the diarrhoea among children.

The following study supports the same findings,

Awasthi (2006) conducted a randomized effectiveness trial to find out the Zinc supplementation in acute diarrhoea in six sites in five countries namely, Fortaleza (Brazil), Addis Adaba (Ethiopia), Cairo (Egypt), Lucknow and Nagpur (India), and Manila (Philippines). Participants were 2,002 children aged 2 to 59 months. Intervention was zinc (20 mg orally, once daily for 14 days) with ORS (zinc group) compared with ORS alone (control group). One thousand ten and 992 children enrolled in zinc and control groups. In five of six sites, ORS use in cases with continued diarrhoea on days 3 to 5 was the same in the two groups or higher in zinc group. In the management of acute watery diarrhoea, zinc plus ORS decreases antibiotic/anti-diarrhoeal use; children had good adherence without side effects.

a. To compare the post-test level of dehydration status score between the experimental group and control group.

According to table -10, mean post-test-1 dehydration score after administration of WHO-ORS (13.6) was significantly higher than the mean post-test-1 dehydration score after administration of WHO-ORS with zinc (11). The mean post-test 2 and 3 dehydration score after administration of WHO-ORS (11) was same as the mean post-test2 and 3 dehydration score after administration of WHO-ORS with zinc (11).The obtained 't' value of 4.3 at df (58) was significant at 0.05 level. The difference between the mean (2.6) is a true difference, and has not occurred by chance. So it can be inferred that WHO-ORS with zinc has a significant role in improving the dehydration status.

The following study supports the same findings,

Yang et al(2007) conducted a multicenter, randomized, double-blind, positive drug controlled clinical trial to assess the efficacy and safety of reduced osmolarity oral rehydration salts (ROORS) in treatment of mild to moderate dehydration caused by acute diarrhoea in children. A total of 125 children who ranged in age from 1 to 17years were enrolled in this study. These children with acute diarrhoea and signs of dehydration were randomly assigned to receive either ROORS (trial group, n = 62) or oral rehydration salts II (ORS II) (control group, n = 63). The volume of intravenous infusion was recorded. The improvements of systemic symptoms and signs, diarrhoea, dehydration and total scores were compared between the two groups. the average volume of intravenously infused fluids in trial group was (450.98 +/- 183.07) ml, 24.5% less than that in the control group (597.30 +/- 343.37) ml ($P < 0.05$).They concluded that ROORS was shown to be effective and safe in the treatment of mild and moderate dehydration induced by acute diarrhoea. Compared to ORS II, ROORS could decrease the intravenous supplement of fluid and lower the risk of hypernatremia.

b. To compare the post-test level of diarrhoeal status score between the experimental group and control group.

According to table- 11, shows that mean post-tests diarrhoeal status score after administration of WHO-ORS (14.8), (12.1) and (9.5) was significantly higher than the mean post-tests diarrhoeal status score after administration of WHO-ORS with zinc (12.9), (9.3) and (8.3). The obtained't' value of 21, 7.8 and 11.5 at df (58) was significant at 0.05 level. The difference between the mean (1.9), (2.8) and (1.2) are true difference, and has not occurred by chance. So it can be inferred that WHO-ORS with zinc has a significant role in improving the diarrhoea.

The following study supports the same findings,

Lazzerini and Ronfani (2008) conducted a Randomized controlled trials to evaluate the oral zinc supplementation for treating children with acute and persistent diarrhoea. Comparing oral zinc supplementation with placebo in children aged one month to five years with acute or persistent diarrhoea were selected as study samples. Eighteen trials enrolling 6165 participants met their inclusion criteria. In acute diarrhoea, zinc resulted in a shorter diarrhoea duration (MD -12.27 h, 95% CI -23.02 to -1.52 h; 2741 children, 9 trials), and less diarrhoea at day three (RR 0.69, 95% CI 0.59 to 0.81; 1073 children, 2 trials), day five (RR 0.55, 95% CI 0.32 to 0.95; 346 children, 2 trials), and day seven (RR 0.71, 95% CI 0.52 to 0.98; 4087 children, 7 trials). Zinc also reduced the duration of persistent diarrhoea (MD -15.84 h, 95% CI -25.43 to -6.24 h; 529 children, 5 trials).

Sangita et al, (2009) conducted a study to find out the daily supplementation of zinc has any effect on clinical course of acute diarrhoea, i.e. frequency of stool, on stool amount and duration of acute diarrhoea. In a randomized double blind placebo controlled trial, 117 children aged 6 months to 59 months in a medical college hospital, with acute diarrhoea of less than 14 days were assigned by permuted block design 1:1 to receive intervention of zinc supplemented syrup (n = 60) or placebo syrup (n = 57).Also they concluded that Oral zinc administration in acute diarrhoea reduces the frequency of diarrhoea and output of stool by changing the natural course of acute diarrhoeal disease, causes early normalization of stool consistency, early recovery and decreases total duration of hospital stay. Zinc supplementation is simple, acceptable and affordable strategy which should be considered in management of acute diarrhoea.

c. To compare the post-test level of stool frequency score between the experimental group and control group.

According to table -12, the mean post-tests on day 2,3 and 4 the stool frequency score after administration of WHO-ORS (9.1), (6.8) and (3.7) was significantly higher than the mean post-tests stool frequency score after administration of WHO-ORS with zinc (7.7), (4.3) and (2). The obtained‘t’ value of 5.4, 5.7 and 6.07 at df (58) was significant at 0.05 level. The difference between the mean (1.4), (2.5) and (1.7) are true difference, and has not occurred by chance. So it can be inferred that WHO-ORS with zinc has a significant role in reducing the stool frequency in diarrhoea.

The following study supports the same findings,

Shinjini Bhatnagar et al (2004) conducted a randomized controlled trial to find out the Zinc with oral rehydration therapy reduces stool output and duration of diarrhoea in

hospitalized children in NewDelhi, India. This double-blind, randomized, controlled trial was conducted at two urban hospitals in New Delhi. A total of 287 dehydrated male patients, ages 3 to 36 months, with diarrhoea for <or= 72 hours were enrolled. They were assigned to zinc or placebo by a randomization scheme stratified by age (<or= or >12 months) and weight for height (65%-80% or >80% National Centre for Health Statistics median). Participants in the zinc group received 15 mg (<or=12 months) or 30 mg (>12 months) elemental zinc daily in three divided doses for 14 days. Zinc treatment reduced total stool output (ratio of geometric means, 0.69; 95% confidence interval [CI]: 0.48, 0.99) and stool output per day of diarrhoea (ratio of geometric means, 0.76; 95% CI: 0.59, 0.98). The risk of continued diarrhoea was lower (relative hazards, 0.76; 95% CI: 0.59, 0.97) and the proportion of diarrhoeal episodes lasting >or= 5 days (odds ratio, 0.49; 95% CI: 0.25, 0.97) or >or= 7 days was less (odds ratio, 0.09; 95% CI: 0.01, 0.73) in the zinc group. This study demonstrates a beneficial effect of zinc administered during acute diarrhoea on stool output, diarrhoeal duration, and proportion of episodes lasting more than 7 days. The effects are large enough to merit routine use of zinc during acute diarrhoea in developing countries.

d. To compare the post-test level of stool consistency score between the experimental group and control group.

According to table -13, the mean post-tests on day 2,3 and 4 the stool consistency score after administration of WHO-ORS (2.4), (2) and (1.5) was significantly higher than the mean post-tests stool frequency score after administration of WHO-ORS with zinc (1.9), (1.3) and (1.1). The obtained‘t’ value of 5.2, 5.8 and 3.64 at df (58) was significant at 0.05 level. The difference between the mean (0.5), (0.7) and (0.4) are true difference,

and has not occurred by chance. So it can be inferred that WHO-ORS with zinc has a significant role in stool consistency in diarrhoea.

The following study supports the same findings,

Karamyyar et al (2008) conducted a Double-Blind Randomized Clinical Trial study to find out the Therapeutic Effects of Oral Zinc Supplementation on Acute Watery Diarrhoea with Moderate Dehydration in Urmia, Iran. All 9-month to 5-year-old children who were admitted with acute watery diarrhoea and moderate dehydration to the Ward were randomly allocated to two groups: one group to receive zinc plus oral rehydration solution (ORS) and the other one to receive ORS plus placebo. All the patients were rehydrated using ORS and then receiving ORS for ongoing loss (10 ml/kg after every defecation). Additionally, the patients in the intervention group received zinc syrup (1 mg/kg/day) divided into two doses. The primary outcome (frequency and consistency of diarrhoea) and the secondary outcomes (duration of hospitalization and change in patients' weight) were compared between the two groups. The mean diarrhoea frequency (4.5±2.3 vs. 5.3±2.1; P=0.004) was lower in the group receiving zinc +ORS; however, the average weight was relatively similar between the two groups (10.5±3.1 vs. 10.1±2.3; P=0.14). The qualitative assessment of stool consistency also confirmed earlier improvement in the treatment group in the first three days of hospitalization (P <0.05). The mean duration of hospitalization was significantly lower in the patients receiving zinc supplements (2.5±0.7 vs. 3.3±0.8 days; P=0.001).

9. The fifth objective was to find out the association between the pre-test dehydration status and selected demographic variables (age, sex, and literacy level of the parents, drinking water-source, sanitation, toilet facility and hand washing habit) in experimental group and control group.

According to table -14, in order to find out the association between diarrhoeal status score and age, the chi –squire test was computed, obtained chi-square value 2.83 at df (2) was not significant at 0.05 level.

Diarrhoeal status score and method of feeding the calculated chi-square value 0.22 at df (2) was not significant at 0.05 level.

Regarding diarrhoeal status score and sex, the calculated chi-square value 0.60 at df (1) was not significant at 0.05 level.

Diarrhoeal status score and educational status of the mother, the calculated chi-square value 3.0 at df (6) was not significant at 0.05 level.

Diarrhoeal status score and educational status of the father, the calculated chi-square value 10.4 at df (6) was not significant at 0.05 level

It was found that there is association between drinking water source, toilet facility, sanitation, habit of hand washing before eating, habit of hand washing after toileting and the diarrhoeal status score.

The obtained chi-square value 21.7 at df (2) was significant at 0.05 level for drinking water source, 9.8 at df (2) was significant at 0.05 level for toilet facility, 19.3 at df (2) was significant at 0.05 level for sanitation, 15.0 at df (2) was significant at 0.05 level for habit of hand washing before eating, and 10.4 at df (2) was significant at 0.05 level for habit of hand washing after toileting.

Regarding diarrhoeal status score and weight of the child, the calculated chi-square value 0.005 at df (2) was not significant at 0.05 level.

This indicates that there is association between drinking water source, toilet facility, sanitation, habit of hand washing before eating, habit of hand washing after toileting and the diarrhoeal status score.

CHAPTER - VI

SUMMARY, CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

This chapter includes the summary, conclusion, and implications of the study in the field of nursing. It also presents the recommendations for the future research.

Summary of the study:

The aim of the study was to evaluate the effectiveness of WHO-ORS with zinc on dehydration and diarrhoeal status among the children aged between 3months to 5 years with diarrhoea .

The following objectives were set for the study

1. The first objective of the study was to assess the pre-test and post-test dehydration and diarrhoeal status among the children in experimental group who had WHO-ORS with zinc.
2. The second objective of the study was to assess the pre-test and post-test dehydration and diarrhoeal status among the children in control group.
3. The third objective of the study was to evaluate the effectiveness of WHO-ORS with zinc on dehydration status among children with diarrhea in experimental group.
4. The fourth objective was to evaluate the effectiveness of WHO-ORS with zinc on diarrhoeal status among children with diarrhea in experimental group.
5. The fifth objective was to find out the association between the pre-test dehydration status and selected demographic variables (age, sex, literacy level of

the parents, drinking water-source, sanitation, toilet facility and hand washing habit) in experimental group and control group.

HYPOTHESIS:

All the hypotheses were tested at 0.05 level of significance,

1. H1 –The mean post-test dehydration status in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean pre-test level of dehydration status.
2. H2- The mean post-test diarrhoeal status in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean pre-test level of diarrhoeal status.
3. H3- The mean post-test dehydration status in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean post-test dehydration status in the control group
4. H4-The mean post-test diarrhoeal status in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean post-test diarrhoeal status in the control group.
5. H5- The mean post-test stool frequency score in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean post-test stool frequency score in the control group
6. H6- The mean post-test stool consistency score in the experimental group of children who had WHO-ORS with zinc will be significantly lesser than the mean post-test stool consistency score in the control group.

7. H7-There will be a significant association between pre-test diarrhoeal status of the children and selected demographic variables (age, sex, literacy level of the parents, Drinking water-source, sanitation, toilet facility and hand washing habit) in control group.

The experimental approach was used for the study. The design adopted was Quasi-experimental-Nonequivalent Pretest-posttest control group design. The study was conducted in Government Rajaji Hospital, which is 5 kms away from Sacred Heart Nursing College. The consecutive sampling technique was adapted for this study. The sample size for the study was 60 among 30 children were in experimental group and 30 children in control group.30 samples were treated with WHO-ORS with zinc and another 30 samples were treated with WHO-ORS. Observational check list on dehydration and diarrhoeal status used for data collection J.W. Kenny's open system model–conceptual frame work has used . Data collection was done for a period of six weeks. After data collection, data was organized, tabulated, summarized and analyzed.

Major findings of the study

I. Demographic characteristics of the samples:

- With regard to age, in both experimental group and control group majority of samples are between 13 months to 3 yrs. 15 (50%) and16 (53.30%) respectively.
- Regarding sex, in experimental group the majority of the samples were female 19 (63.3%) and in control group the majority of the samples were male 17 (56.6%).
- With regard to mother's educational status in experimental group, 4(13.3%) were illiterates, where as in control group, 1(3%) was illiterate.

- With regard to father's educational status in experimental group, 28(93.3%) were illiterates, where as in control group, 30 (100%) were illiterates.
- Regarding drinking water source, majority of samples used water supplied by the government (without boiling), 16(53.3%) in both groups.
- With regard to toilet facility, open field defecation used by 13(43.3%) in experimental group, 12(40%) in control group.
- Regarding sanitation the distribution was same in both experimental and control group, 15 (50%) properly disposed in the garbage, 15(50%) had improperly disposed in the garbage.
- With regard to habit of hand washing before eating majority of the samples did not wash their hands in both groups 17(56.6%) in experimental group and16(53.3%)in control group.
- With regard to habit of hand washing after toileting in both groups, majority of the samples washed their hands with plain water 21(70%)in experimental group, and 15(50%)in control group.
- Regarding weight of the child the distribution was almost same in both experimental and control group, 27(90%) in experimental group and 29(96.7%) in control group.
- With regard to duration of illness majority of the samples in experimental and control group were between 2 to 5 days 24(80%), and 22(73.3%).
- Regarding vomiting majority of samples presented with no vomiting in both experimental and control group 27(90%) and 25(83.3%) respectively.

The above data shows that the experimental and control groups were similar in forms of the demographic variables such as age, parents education, drinking water source, sanitation, toilet facility, habit of hand washing before eating ,habit of hand washing after toileting , weight of the child, duration of illness, and vomiting.

II. Distribution of participants according to the level of dehydration in experimental group, 30 (100%) were under some dehydration in pre-test and after intervention post-test result showed 30 (100%) had no dehydration in post-test 1, 2 and 3 respectively. With regard to diarrhoeal status in pre-test, 15(50%) had severe diarrhoeal status and in the post-test one, 30(100%) had moderate diarrhoeal status, in post-test two, 12 (40%) had mild diarrhoeal status, 18(60%) had moderate diarrhoeal status and in post-test three, 25(83.3%) had mild diarrhoeal status, 5(16.7%) had moderate diarrhoeal status.

III. Distribution of participants according to the level of dehydration in control group 30 (100%) had some dehydration in pre-test, 30 (100%) where as in post-test 1, 4(13.3%) had no dehydration, 26(86.7%) had some dehydration. In post-test 2 and 3, 30 (100%) had no dehydration. With regard to diarrhoeal status in pre-test on day one, 15(50%) had moderate diarrhoeal status and 15(50%) had severe diarrhoeal status. In the post-test one on day two, 27(90%) had moderate diarrhoeal status, 3(10%)had severe diarrhoeal status, in post-test two on day three, 27(90%) had moderate diarrhoeal status, 3(10%) had mild diarrhoeal status and in post-test three on day four, 15(50%) had mild diarrhoeal status ,15(50%) had moderate diarrhoeal status.

IV. The mean post-test-1 dehydration score after administration of WHO-ORS (13.6) was significantly higher than the mean post-test one dehydration score after administration of WHO-ORS with zinc (11).

V. The mean post-tests diarrhoeal status score after administration of WHO-ORS (14.8), (12.1) and (9.5) was significantly higher than the mean post-tests diarrhoeal status score after administration of WHO-ORS with zinc (12.9), (9.3) and (8.3).

VI. The mean post-tests on day two, three and four the stool frequency score after administration of WHO-ORS (9.1), (6.8) and (3.7) was significantly higher than the mean post-tests stool frequency score after administration of WHO-ORS with zinc (7.7), (4.3) and (2).

VII. The mean post-tests on day two, three and four the stool consistency score after administration of WHO-ORS (2.4), (2) and (1.5) was significantly higher than the mean post-tests stool frequency score after administration of WHO-ORS with zinc (1.9), (1.3) and (1.1).

VIII. There was a significant association between pre-test diarrhoeal status score and drinking water source in experimental and control group. (Chi-square value 21.7 at df2)

IX. There was a significant association between pre-test diarrhoeal status score and toilet facility in experimental and control group. (Chi-square 9.8 at df 2)

X. There was a significant association between pre-test diarrhoeal status score and sanitation in experimental and control group. . (Chi-square 19.3 at df 2).

XI. There was a significant association between pre-test diarrhoeal status score and habit of hand washing before eating in experimental and control group. (Chi-square 15.0 at df 2).

XII. There was a significant association between pre-test diarrhoeal status score and habit of hand washing after toileting in experimental and control group. (Chi-square10.4 at df 2).

CONCLUSION

The following conclusions were drawn from the study,

1. The level of dehydration status of subjects after the administration of WHO-ORS with zinc was lower than the level of dehydration status before the use of WHO-ORS with zinc.
2. The level of diarrhoeal status of subjects after the administration of WHO-ORS with zinc was lower than the level of diarrhoeal status before the use of WHO-ORS with zinc.
3. The WHO-ORS with zinc was found effective in improving the dehydration and diarrhoea among children aged between 3months to 5 years.

IMPLICATIONS

The findings of the study have practical applications .The study could be discussed in four areas namely nursing practice, nursing administration, nursing education and research.

Implications for nursing practice

The findings of the study will help the nurse in the following ways.

1. Early identification and prevention of dehydration among children with diarrhoea.
2. As WHO-ORS with zinc is less expensive and has no adverse effects, nurses can use readily.
3. Nurses must assess the children with diarrhoea by using observational checklist to detect the dehydration and diarrhoeal status and treat accordingly.

4. The study findings will help the nursing personnel to include this nursing intervention in the management of diarrhoea among children aged between 3months to 5 years.
5. There should be a routine practice of using WHO-ORS with zinc in the management of diarrhoea among children aged between 3months to 5 years.

Implications for nursing education

1. The study has clearly proved that WHO-ORS with zinc was more effective in improving hydration and diarrhoea.
2. These findings would help the nursing faculty to give importance to WHO-ORS with zinc in management of diarrhoea among children aged between 3months to 5 years and motivate the nursing students in management of diarrhoea among children in the same age group.
3. Different type of dehydration and diarrhoeal assessment scale can be included in the nursing curriculum.

Implications for nursing research

There is a need for extensive and intensive research in this area. One of the aims of nursing research is to expand and broaden the scope of nursing. Findings of this study will provide baseline data about the improvement of hydration and diarrhoeal status and it can be used for further studies in this area.

Implications for nursing administration

1. Nursing administrators can encourage the nursing personnel to conduct research among children with diarrhoea and give care based on findings.

2. Periodic conference, seminars and symposium can be arranged for nursing personnel regarding care of child with diarrhoea.
3. Education should be given to clinical nurses and nurse educators to update knowledge regarding management of children with diarrhoea.
4. Nursing administrators should prepare guidelines and protocols regarding administration of WHO-ORS with zinc and use them in wards and ensure the availability.

LIMITATIONS

1. Because of small sample size, findings must be interpreted with caution.
2. This study was limited to children with diarrhoea aged between 3 months to 5 years admitted at Government Rajaji hospital Madurai.
3. WHO-ORS with zinc was administered only for a period of 3 days.

RECOMMENDATIONS FOR THE STUDY

1. The study can be conducted using large population to generalize the findings.
2. A longitudinal study can be conducted to assess the effectiveness of selected nursing intervention on reducing diarrhoea among children.
3. Various other oral rehydrating solutions can be administered among children with diarrhoea as a comparative study in different settings.
4. Various other oral rehydrating solutions can be administered among children with diarrhoea as a comparative study in similar setting.
5. The effectiveness of WHO-ORS with zinc can be tested for other age groups.

6. Qualitative study can be conducted to identify the in – depth problems associated with diarrhoea among children.
7. Incidence of dehydration and diarrhoea can be assessed among children with diarrhoea.
8. The same study can be repeated using the true experimental design.

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APPENDIX - I

COPY OF THE LETTER SEEKING PERMISSION TO CONDUCT THE STUDY IN GOVERNMENTAL RAJAJI HOSPITAL, MADURAI

Ref: UT: SHNC: 2013

Sacred Heart Nursing College

Ultra trust, 4/235, college road

Madurai-625 020

To,

The Dean,

Government Rajaji Hospital,

Madurai

Respected sir/madam,

SUB: Sacred Heart Nursing College, Madurai-project work of M.Sc (N) student-permission-reg.

We wish to state that _____ final year M.sc., (N) student of our college has to conduct a research project, which is to be submitted to the Tamilnadu DR.M.G.R.Medical University Chennai, in partial fulfillment of university requirements.

The topic of research project is "A study to evaluate the effectiveness of WHO ORS with zinc on dehydration and diarrhoeal status among the children aged between 3months to 5 years with diarrhea admitted in Government Rajaji Hospital at Madurai."

We therefore request you to kindly permit her to do the research work under your valuable guidance and suggestions.

Thanking you.

Yours faithfully,

SACRED HEART NURSING COLLEGE

ULTRA TRUST, MADURAI-2

APPENDIX - II

COPY OF LETTER SEEKING EXPERTS OPINION FOR TOOL AND CONTENT VALIDITY

From, _____

M.sc (nursing) II year

Sacred Heart College of nursing,

Madurai-20

To,

Respected Sir/Madam,

SUB: Requesting opinions and suggestion of experts for the content validity and validity of tool.

I am a post graduate student (child health nursing) of the sacred heart nursing college. I have selected the below mentioned topic for research project to be submitted to Tamilnadu DR.M.G.R. Medical university Chennai, as a fulfillment of Master of Science in nursing.

TITAL OF THE RESEARCH PROJECT:

A study to evaluate the effectiveness of WHO ORS with zinc on dehydration and diarrhoeal status among the children aged between 3months to 5 yrs with diarrhea admitted in Government Rajaji Hospital at Madurai.

With regard to this may I kindly request you to validate the content of my tool for its relevancy. I am enclosing the objectives of the study. I would be highly obliged and remain thankful if you could validate and send it as early as possible.

Thanking you.

Encl:

1. Problem statement & objectives.
2. Demographic data..
3. Clinical evaluation checklist on dehydration.
4. Observational check list on diarrhoeal status.

Place: yours faithfully,

Date: _____

APPENDIX - III

CONTENT VALIDITY CERTIFICATE

This is to certify that I _____ have gone through the tool submitted by Mrs.V. Hemalatha doing her research project as a fulfillment of master of science in nursing under the Tamilnadu Dr.M.G.R Medical University, Chennai.

The statement of problem in her study is "A Study to evaluate the effectiveness of low osmolarity WHO ORS with ZINC on dehydration and diarrhoeal status among the children aged between 3 months to 5 years with diarrhoea admitted in government Rajaji hospital in Madurai."

I have gone through the tool for content validity. I certify that this tool can be used for above mentioned study.

Signature, Designation & seal of the expert

APPENDIX - IV

LIST OF EXPERTS

1. **Dr. Sambath M.D., (pediatrics)**

   Unit chief

   Government Rajaji hospital,

   Madurai.

2. **Dr. Sundara pandian M.D., (Pediatrics)**

   Pediatric consultant

   Padma clinic

   Madurai

3. **Dr. Sivakumar M.D., (Pediatrics)**

   Assistant professor

   Government Rajaji hospital,

   Madurai.

4. **Mrs. Chandrakala M.sc (Nursing), Ph.D.,**

   Professor in Medical –surgical Nursing,

   Sacred heart College of Nursing,

   Madurai.

5. **Dr. Juliet Sylvia M.sc (Nursing), Ph.D.,**

   H.O.D of community Health Nursing,

   Sacred heart College of Nursing,

   Madurai.

6. **Mrs. Devakirubi M.sc (Nursing), Ph.D.,**

   Professor in Medical –surgical Nursing,

   Sacred heart College of Nursing,

   Madurai.

7. **Mrs. Jothilakshmi, M.Sc (Nursing)**

   Associate Professor in Child health nursing

   Sacred heart College of Nursing,

   Madurai.

8. **Mrs. Damayanthi , M.Sc (N),**

   Lecturer in Child health nursing

   Sacred heart College of Nursing,

   Madurai.

9. **Mr. Jeyaram Illaiyaraja M.Sc., M.Phil.**

   Statistician,

   Aravind Eye Hospital,

   Madurai.

APPENDIX - V

DEMOGRAPHIC DATA

1. Age of the child :

   a) 3months – 12 months

      If, the child comes under this category, the child is on …….. 1. Breast feeding

      2. Bottle feeding

      3. Both

   b) 13 months - 3yrs

   c) 3yrs - 5 yrs

2. Sex

   a) Male

   b) Female

3. Educational status of the mother:

   a) Illiterate

   b) Primary level education

   c) Middle school level education

   d) High school level education

   e) Higher secondary

   f) Graduate

   g) Post graduate

4. Educational status of the father:

   a) Illiterate

   b) Primary level education

   c) Middle school level education

d) High school level education

e) Higher secondary

f) Graduate

g) Post graduate

5. Drinking water -source

a. Water purified by reverse osmosis.

b. Boiled cooled water.

If boiling how long…..

1. 20 minutes from initial boiling
2. 10 minutes from initial boiling
3. One minute from initial boiling

c. Water supplied by the government (without boiling)

6. Toilet facility

a. sanitary toilet with septic tank

b. Single toilet shared by many families

c. Open field defecation

7. Sanitation

a. Proper disposal of garbage

b. Improper disposal of garbage

8. Habit of hand washing before eating

a. with plain water

b. with soapy water

c. No habit of hand washing

9. Habit of hand washing after toileting

a. With plain water

b. With soapy water

c. No hand washing habit

10. Weight of the child: _____

a. Appropriate for age

b. Over weight for age

c. Malnourished

11. Duration of diarrhoea

a. < 2 days

b. 2 – 5 days

c. > 5 days

12. Vomiting

a. None

b. Some

c. Very frequent

APPENDIX - VI

CLINICAL EVALUATION CHECK LIST ON DEHYDRATION

NO OF ITEMS	CHARACTERISTICS'	SCORING	PRESENT	NOT PRESENT
1.	The condition of the child			
	a. Alert	1		
	b. Unwell, sleepy or irritable	2		
	c. Very sleepy, unconscious or having fits	3		
2.	Anterior Fontanels			
	a. Normal	1		
	b. Depressed	2		
	c. Sunken	3		
3.	Eyes			
	a. Normal	1		
	b. Sunken	2		
	c. Very dry and sunken	3		
4.	Tears			
	a. Present	1		
	b. Minimal tears	2		
	c. Absent	3		
5.	Mouth and tongue			
	a. Moist	1		
	b. Dry	2		
	c. Dry mouth and tongue with cracked lips	3		
6.	Thirst			
	a. Normal	1		
	b. The child shows interest and eagerness to drink when offered to drink.	2		
	c. Lethargic and not interested to drink.	3		
7.	Heart rate (beats /min)			
	A.3months – 12 months			
	a. 120- 140	1		
	b. >140	2		
	c. <120	3		

	B.13months to 3 yrs a. 110 – 130 b. > 130 c. < 110 C. 3 yrs – 5 yrs a. 90 – 110 b. >110 c. <90	 1 2 3 1 2 3		
8.	Respiratory rate (breaths / min) A.3months – 12 months a. 30- 40 b. >40 c. <30 B.13months to 3 yrs a. 26- 30 b. > 30 c. < 26 C. 3 yrs – 5 yrs a. 22 – 28 b. > 28 c. < 22	 1 2 3 1 2 3 1 2 3		
9.	Skin turgor (a pinch goes back) a. Immediately b. Slowly (skin stays up even for a brief instant c. Very slowly (> 2 sec)	 1 2 3		
10.	Urine a. Normal b. A small amount of dark urine c. No urine for 6 hrs	 1 2 3		
11.	Weight loss a. Up to 5 % b. 6 – 9 % c. 10 % or more	 1 2 3		

Total score - 33

1-11 (No dehydration), 12-22 (Some dehydration), 23-33 (Severe dehydration)

APPENDIX - VII

OBSERVATIONAL CHECKLIST ON DIARRHOEAL STATUS

ITEM NO	CHARACTERISTICS	SCORE	YES	NO
1.	No.of liquid stools per day			
	a. Less than 4 liquid stools / day	1		
	b. 4 to 10 liquid stools / day	2		
	c. More than 10 liquid stools / day	3		
2.	Quantity of the stool			
	a. Small	1		
	b. Medium	2		
	c. Large	3		
3.	Colour of the stool			
	a. Yellow in colour.	1		
	b. Greenish in colour.	2		
	c. Any other color.(black, red, white)	3		
4.	Consistency of the stool			
	a. Pasty stool	1		
	b. Loose	2		
	c. Watery stool expelled with force.	3		
5.	Odour of the stool			
	a. Normal odour	1		
	b. Foul smelling	2		
	c. Fishy odour	3		
6.	Mucus seen in the stool			
	a. Absence of mucus	1		
	b. Less mucus	2		
	c. More amount of mucus	3		
7.	Blood seen in the stool			
	a. Absence of blood	1		
	b. Mild blood stained	2		
	c. More amount of blood	3		
8.	Pain (abdominal pain)while passing stool			
	a. Absence of pain	1		
	b. Presence of pain	2		
	c. Presence of Severe pain	3		

	While passing stool **3 months to 3 yrs** 0- No cry 1- The child cries 2- The child cries and pulls up legs towards abdomen.	While passing stool **3 yrs to 5 yrs** 0-No complaint of pain 1-Complaint of pain 2-The child cries with complaint of pain		

Interpretation

TOTAL SCORE -14

1 – 8	:	Mild Diarrhoea
9 – 16	:	Moderate Diarrhoea
17 – 24	:	Severe Diarrhoea